TECHNICAL BACKGROUND DOCUMENT

Environmental Evaluation of Existing and Proposed Mining Operations APPENDICES

Occidental Chemical Agricultural Products, Inc.
Hamilton County, Florida

Prepared by

Environmental Services & Permitting, Inc.
P.O. Box 5489
Gainesville, Florida 32602

May 1985

Department of the Army, Jacksonville District
Corps of Engineers

TABLE OF CONTENTS

APPENDIX A

WATER RESOURCES DATA

TABLE OF CONTENTS

APPENDIX A.1

1981 MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.), SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
JAN. 1981								
1					ND	ND	ND	ND
2				0.01	ND	ND	ND	ND
3					ND	ND	ND	ND
4					ND	ND	ND	ND
5					ND	ND	ND	ND
6	0.55	0.31	0.46		ND	ND	ND	ND
7				0.46	ND	ND	ND	ND
8					ND	ND	ND	ND
9					ND	ND	ND	ND
10					ND	ND	ND	ND
11					ND	ND	ND	ND
12					ND	ND	ND	ND
13					ND	ND	ND	ND
14				0.08	ND	ND	ND	ND
15	0.05	0.11	0.20	0.01	ND	ND	ND	ND
16					ND	ND	ND	ND
17					ND	ND	ND	ND
18					ND	ND	ND	ND
19					ND	ND	ND	ND
20		0.37			ND	ND	ND	ND
21	0.22	0.06	0.36	0.36	ND	ND	ND	ND
22				0.01	ND	ND	ND	ND
23					ND	ND	ND	ND
24					ND	ND	ND	ND
25					ND	ND	ND	ND
26					ND	ND	ND	ND
27					ND	ND	ND	ND
28	0.08	0.12	0.45	0.33	0.30	ND	ND	ND
29						ND	ND	ND
30						ND	ND	ND
31						ND	ND	ND
SUM	0.90	0.97	1.47	1.26	*0.30			

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
FEB. 1981								
1						ND	ND	ND
2	0.55	0.48	0.81	0.48	0.46	ND	ND	ND
3						ND	ND	ND
4						ND	ND	ND
5						ND	ND	ND
6		0.20		0.26	0.25	ND	ND	ND
7	0.19	0.10	0.32	0.01	0.01	ND	ND	ND
8	0.03		0.03			ND	ND	ND
9						ND	ND	ND
10						ND	ND	ND
11	2.55	3.22	3.46	2.32	2.94	ND	ND	ND
12						ND	ND	ND
13						ND	ND	ND
14						ND	ND	ND
15	0.01					ND	ND	ND
16	0.01		0.09			ND	ND	ND
17	0.01			0.02		ND	ND	ND
18	2.42	1.22	0.72	2.64	3.22	ND	ND	ND
19	0.86	1.45	1.71		0.01	ND	ND	ND
20						ND	ND	ND
21						ND	ND	ND
22						ND	ND	ND
23						ND	ND	ND
24						ND	ND	ND
25						ND	ND	ND
26						ND	ND	ND
27						ND	ND	ND
28						ND	ND	ND
SUM	6.63	6.67	7.14	5.73	6.89			

ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
MARCH 1981								
1						ND	ND	ND
2						ND	ND	ND
3						ND	ND	ND
4				0.12	0.72	ND	ND	ND
5	1.72	1.73	3.94	2.49	2.18	ND	ND	ND
6						ND	ND	ND
7						ND	ND	ND
8						ND	ND	ND
9						ND	ND	ND
10						ND	ND	ND
11					ND	ND	ND	ND
12					ND	ND	ND	ND
13				0.01	ND	ND	ND	ND
14					ND	ND	ND	ND
15					ND	ND	ND	ND
16	0.15	0.07		0.02	ND	ND	ND	ND
17					ND	ND	ND	ND
18	0.06	0.09		0.12	ND	ND	ND	ND
19	0.01		0.16	0.05	ND	ND	ND	ND
20					ND	ND	ND	ND
21					ND	ND	ND	ND
22	0.12	1.14	0.30	0.26	ND	ND	ND	ND
23	0.54		0.80	ND	ND	ND	ND	ND
24				ND	ND	ND	ND	ND
25				ND	ND	ND	ND	ND
26				ND	ND	ND	ND	ND
27				ND	ND	ND	ND	ND
28				ND	ND	ND	ND	ND
29				ND	ND	ND	ND	ND
30		1.55		ND	ND	ND	ND	ND
31	1.51	0.39	1.48	ND	ND	ND	ND	ND
SUM	4.11	4.97	6.68	*3.07	*2.90			

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
APRIL 1981								
1	1.02	0.48	0.66		1.95	ND	ND	ND
2	0.03		1.70			ND	ND	ND
3						ND	ND	ND
4						ND	ND	ND
5				0.07		ND	ND	ND
6	0.10	0.07	0.10			ND	ND	ND
7					0.07	ND	ND	ND
8						ND	ND	ND
9						ND	ND	ND
10						ND	ND	ND
11						ND	ND	ND
12						ND	ND	ND
13						ND	ND	ND
14						ND	ND	ND
15		0.08				ND	ND	ND
16			0.02			ND	ND	ND
17						ND	ND	ND
18						ND	ND	ND
19						ND	ND	ND
20				0.22		ND	ND	ND
21	0.10	0.62	0.32	ND		ND	ND	ND
22				ND		ND	ND	ND
23				ND		ND	ND	ND
24	0.13		0.05	ND		ND	ND	ND
25				ND		ND	ND	ND
26				ND		ND	ND	ND
27				ND		ND	ND	ND
28				ND		ND	ND	ND
29				ND		ND	ND	ND
30				ND		ND	ND	ND
SUM	1.38	1.25	2.85	*0.29	2.02			

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
MAY 1981								
1				ND		ND	ND	ND
2				ND		ND	ND	ND
3				ND		ND	ND	ND
4				ND		ND	ND	ND
5				ND		ND	ND	ND
6		0.26		ND		ND	ND	ND
7	1.50	1.24	1.82	ND		ND	ND	ND
8			0.01	ND		ND	ND	ND
9	0.02			ND	1.04	ND	ND	ND
10	0.01			ND		ND	ND	ND
11				ND		ND	ND	ND
12				ND		ND	ND	ND
13				ND		ND	ND	ND
14				ND		ND	ND	ND
15				ND		ND	ND	ND
16				ND		ND	ND	ND
17				ND		ND	ND	ND
18				ND		ND	ND	ND
19				ND		ND	ND	ND
20				ND		ND	ND	ND
21				ND		ND	ND	ND
22				ND		ND	ND	ND
23				ND		ND	ND	ND
24				ND		ND	ND	ND
25				ND		ND	ND	ND
26				ND		ND	ND	ND
27	0.57	0.12	0.16	ND		ND	ND	ND
28	0.01			ND		ND	ND	ND
29				ND	0.43	ND	ND	ND
30				ND		ND	ND	ND
31				ND		ND	ND	ND
SUM	2.11	1.62	1.99	1.47				

ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
JUNE 1981								
1				ND		ND	ND	ND
2	0.30	0.60		0.07		ND	ND	ND
3			0.31			ND	ND	ND
4		0.62			0.16	ND	ND	ND
5	1.47	0.93	0.05			ND	ND	ND
6	0.82	0.21		0.08	0.20	ND	ND	ND
7	0.73		0.05	0.06	0.02	ND	ND	ND
8		0.06	0.35	0.05	0.34	ND	ND	ND
9		0.02	0.13		0.53	ND	ND	ND
10	0.35	0.68		0.34		ND	ND	ND
11	0.26	0.06	0.45	0.01		ND	ND	ND
12	0.97	1.25	0.15	0.29	0.75	ND	ND	ND
13		0.11	0.02		0.01	ND	ND	ND
14					0.32	ND	ND	ND
15					0.01	ND	ND	ND
16						ND	ND	ND
17				0.14		ND	ND	ND
18	1.50			0.45		ND	ND	ND
19	0.05	0.06	0.18	0.01		ND	ND	ND
20	0.06	0.01		ND		ND	ND	ND
21	0.05			ND		ND	ND	ND
22			0.10	ND		ND	ND	ND
23				ND	0.09	ND	ND	ND
24	0.84	0.46	0.54	ND	1.93	ND	ND	ND
25				ND	ND	ND	ND	ND
26	1.87	0.39		ND	ND	ND	ND	ND
27			0.22	ND	ND	ND	ND	ND
28		0.09		ND	ND	ND	ND	ND
29				ND	ND	ND	ND	ND
30				ND	ND	ND	ND	ND
SUM	9.27	5.55	2.55	*1.50	*4.36			

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
JULY 1981								
1				ND	ND	ND	ND	ND
2	0.18			ND	ND	ND	ND	ND
3				ND	ND	ND	ND	ND
4	0.10	0.09		ND	ND	ND	ND	ND
5		0.02	0.14	ND	ND	ND	ND	ND
6	0.21		0.63	ND	ND	ND	ND	ND
7				ND	ND	ND	ND	ND
8				ND	ND	ND	ND	ND
9	0.30	0.34	0.57	ND	ND	ND	ND	ND
10		0.08		ND	ND	ND	ND	ND
11				ND	ND	ND	ND	ND
12				ND	ND	ND	ND	ND
13				ND	1.31	ND	ND	ND
14	0.15	0.19		ND		ND	ND	ND
15				ND		ND	ND	ND
16				ND	0.32	ND	ND	ND
17			0.08	ND	0.01	ND	ND	ND
18		1.17	0.05	ND	0.08	ND	ND	ND
19	0.40	0.88	0.30	ND		ND	ND	ND
20		0.75	0.82	ND		ND	ND	ND
21	0.03	0.05		ND		ND	ND	ND
22	0.03			ND	0.05	ND	ND	ND
23	1.78		0.24	ND	0.97	ND	ND	ND
24	0.10		0.05	ND		ND	ND	ND
25	0.11			ND	0.01	ND	ND	ND
26				ND		ND	ND	ND
27				ND		ND	ND	ND
28				ND		ND	ND	ND
29		0.07		ND		ND	ND	ND
30		0.26	0.39	ND	0.79	ND	ND	ND
31	2.75	0.03	1.70	ND	0.38	ND	ND	ND
SUM	6.14	3.93	4.97	*3.92				

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
AUG. 1981								
1	0.11	2.88	0.70	ND	0.15	ND	ND	ND
2	0.47		0.15	ND	0.99	ND	ND	ND
3	0.67	0.06	0.23	ND	1.08	ND	ND	ND
4	0.28	0.61		ND		ND	ND	ND
5	0.35		0.17	ND	0.25	ND	ND	ND
6	0.32			ND	0.01	ND	ND	ND
7				ND		ND	ND	ND
8			0.03	ND		ND	ND	ND
9	0.11	0.12	0.07	ND		ND	ND	ND
10		0.02	0.82	ND	0.01	ND	ND	ND
11	0.14	0.01		ND	1.25	ND	ND	ND
12	2.01	1.99	1.45	ND		ND	ND	ND
13			0.63	ND	0.01	ND	ND	ND
14	0.27		1.67	ND		ND	ND	ND
15				ND		ND	ND	ND
16				ND		ND	ND	ND
17				ND		ND	ND	ND
18		0.09		ND	0.72	ND	ND	ND
19	0.05			ND		ND	ND	ND
20		0.62	0.04	ND	0.01	ND	ND	ND
21	0.05	0.27	0.04	ND	1.35	ND	ND	ND
22	0.17		0.57	ND	0.29	ND	ND	ND
23	0.60	0.04	1.97	ND	0.37	ND	ND	ND
24	0.39		0.28	ND		ND	ND	ND
25				ND		ND	ND	ND
26				ND		ND	ND	ND
27		0.65		0.01	1.69	ND	ND	ND
28	0.85	0.30	0.87	3.01	0.71	ND	ND	ND
29	1.85	0.88	0.17	0.23	1.18	ND	ND	ND
30	0.86	0.58	0.43	0.93	0.36	ND	ND	ND
31	0.10		1.10			ND	ND	ND
SUM	9.65	9.12	11.39	*4.18	10.43			

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
SEPT. 1981								
1						ND	ND	ND
2						ND	ND	ND
3						ND	ND	ND
4				0.03		ND	ND	ND
5	0.02					ND	ND	ND
6		0.58		0.06	0.02	ND	ND	ND
7	0.14		0.65			ND	ND	ND
8	0.11			0.12	0.77	ND	ND	ND
9			0.21			ND	ND	ND
10						ND	ND	ND
11						ND	ND	ND
12						ND	ND	ND
13						ND	ND	ND
14						ND	ND	ND
15						ND	ND	ND
16		0.92		1.15	1.54	ND	ND	ND
17	1.10		0.94		0.01	ND	ND	ND
18							ND	ND
19							ND	ND
20							ND	ND
21				0.33	0.21		ND	ND
22			0.11			0.01	ND	ND
23							ND	ND
24							ND	ND
25							ND	ND
26							ND	ND
27	0.03						ND	ND
28							ND	ND
29							ND	ND
30				0.01			ND	ND
SUM	1.40	1.50	1.91	1.70	2.55	*0.01		

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
OCT. 1981								
1							ND	ND
2							ND	ND
3							ND	ND
4							ND	ND
5							ND	ND
6							ND	ND
7							ND	ND
8				0.01	0.02	0.01	ND	ND
9	0.02		0.05				ND	ND
10		0.23		0.60	0.06	0.39	ND	ND
11	0.46		0.16	0.02	0.03	0.01	ND	ND
12			0.05				ND	ND
13							ND	ND
14							ND	ND
15				0.01			ND	ND
16							ND	ND
17				0.01			ND	ND
18				0.06	0.07	0.07	ND	ND
19	0.20	0.11			0.01		ND	ND
20							ND	ND
21							ND	ND
22				0.03		0.06	ND	ND
23			0.03				ND	ND
24				0.36	0.35	0.20	ND	ND
25	0.31	0.37	0.37	0.05	0.01	0.01	ND	ND
26	0.03	0.87	0.62	0.82	0.57	0.79	ND	ND
27			0.02				ND	ND
28							ND	ND
29							ND	ND
30	0.02						ND	ND
31							ND	ND
SUM	1.04	1.58	1.30	1.97	1.12	1.54		

ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
NOV. 1981								
1				0.01			ND	ND
2	0.05	0.03				0.01	ND	ND
3			0.02				ND	ND
4	0.06	0.10		0.52	0.65	0.45		ND
5	0.65	1.37	0.75	1.19	1.27	1.36	1.24	ND
6	1.78		0.62					ND
7								ND
8							0.01	ND
9								ND
10	0.10	1.18		1.26	1.69	1.63	1.69	ND
11	2.01	0.59	1.73	0.04	0.01	0.08	0.08	ND
12	0.01							ND
13								ND
14								ND
15								ND
16				0.14	0.13	0.06	0.06	ND
17	0.03		0.70		0.01		0.01	ND
18								
19								
20		0.02	0.36	0.01	0.02	0.48	0.28	0.16
21				ND				
22				ND				
23				ND				
24				ND				
25	0.06			ND				
26				ND				
27				ND				
28				ND				
29				ND				
30				ND				
SUM	4.75	3.29	4.18	*3.17	3.78	4.07	*3.37	*0.16

*PARTIAL SUM
ND - NO DATA

MONTHLY SUMMARY OF DAILY PRECIPITATION (IN.),
SITES ADJACENT TO AND INSIDE THE OXY STUDY AREA

DATE	STATION							
	LAKE CITY	LIVE OAK	JASPER	SS-2	HC-3	SC-4	RO-3	RC-5
DEC. 1981								
1				ND			0.34	0.34
2	1.43	0.56	0.77	ND	0.34	0.26	0.37	0.09
3	0.03		0.02	ND	0.23	0.29		
4				ND				
5				ND				
6				ND			0.01	
7				ND				
8				ND				
9				ND				
10				ND				
11				ND				
12		0.20	0.03	ND	0.12	0.19	0.17	0.09
13	0.20	0.10	0.18	ND				
14	0.01	0.03		ND	0.27	0.18	0.10	0.25
15	0.55	1.14	1.05	ND	1.05	0.88	0.83	0.83
16			0.20	ND				
17				ND			0.01	
18	0.01	0.01	0.05	ND			0.01	
19				ND				
20				ND				
21				ND				
22	0.02			ND				
23			0.06	ND				
24				ND				
25		0.33	0.02	ND	0.36	0.38	0.54	0.09
26	0.31	0.20	0.21	ND	0.13	0.11	0.15	0.09
27	0.06		0.02	ND				
28	0.02	0.02		ND				
29		0.03		ND	0.10	0.50	0.29	0.10
30	0.44	0.64	0.47	ND	0.53	0.41	0.49	1.39
31	0.12	0.82	0.90	ND	1.05	1.20	1.12	1.14
SUM	3.20	4.08	3.98	4.18	4.40	4.43	4.41	

ND - NO DATA

APPENDIX A.2

SUMMARY USGS DATA FOR SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA NOVEMBER 1968 TO DECEMBER 1980

Summary USGS Data for Selected Sites in the Suwannee River Basin, Florida, November 1968 to December 1980.

Parameter	Station									
	02314986		02315000		02315005		02315200		02315392	
Flow (cfs)	65[1]	84[2]	36	1,536	69	24	28	64	29	29
	0[3]	2,340[4]	10	6,330	0.34	425	0.35	466	0.16	221
Conductivity (µmhos/cm)	62	80	39	51	70	228	28	74	29	90
	24	160	35	90	34	630	40	225	30	210
pH, field	62	4.3	39	4.2	70	6.5	28	5.2	29	5.4
	3.1	7.4	3.1	6.9	3.5	8.1	3.6	7.2	3.5	7.8
Dissolved fluoride as F (mg/l)	62	0.3	36	0.1	71	1.4	28	0.1	29	0.2
	0	0.6	0	0.4	0.2	5.0	0	0.4	0	0.4
Total phosphorus as P (mg/l)	59	0.103	33	0.066	65	1.478	19	0.151	20	0.141
	0.020	0.300	0.020	0.250	0.300	6.200	0.050	0.890	0.050	0.330
Orthophosphate as P (mg/l)	60	0.098	33	0.057	65	1.366	18	0.136	20	0.114
	0.020	0.270	0.020	0.220	0.015	6.000	0.050	0.740	0.050	0.260
Temperature, field (°C)	62	18.3	39	20.0	70	19.3	28	18.6	29	18.4
	4.0	28.0	5.5	31.0	7.0	28.0	5.0	27.0	4.5	27.5
Dissolved oxygen (mg/l)	61	6.6	34	7.6	61	6.4	23	7.6	23	6.8
	3.7	10.8	5.1	12.0	2.6	11.4	4.3	12.3	4.2	11.0
Dissolved oxygen (% sat.)	54	67	32	80	52	68	20	75	20	68
	35	90	54	95	32	94	41	101	46	99
BOD_5 (mg/l)	53	0.8	33	0.8	56	2.4	6	1.4	7	0.7
	0	2.3	0.1	1.7	0	8.1	0.8	3.1	0.2	1.5
Turbidity (JTU)	48	3	17	3	49	16	12	2	13	2
	1	15	1	8	3	190	1	5	1	7
Total ammonia as N (mg/l)	59	0.054	33	0.040	64	1.689	19	0.292	20	0.038
	0	0.160	0	0.190	0.010	15.000	0.020	4.800	0.010	0.100
Total nitrate as N (mg/l)	58	0	33	0	64	0.60	19	0.03	20	0.03
	0	0.03	0	0.04	0	3.6	0	0.24	0	0.11
Total nitrite as N (mg/l)	58	0.026	33	0.013	64	0.047	19	0.028	20	0.016
	0	0.060	0.010	0.030	0.010	0.180	0.010	0.110	0.010	0.020
Total organic nitrogen as N (mg/l)	63	1.2	34	0.79	66	0.95	19	0.82	20	0.80
	0.26	4.9	0.37	1.6	0.22	2.5	0.50	1.5	0.15	1.4
Total organic carbon as C (mg/l)	58	57	32	36	63	19	19	40	20	37
	4.0	100	16	48	6.0	52	10	64	2.7	60
Total coliform (cols./100 ml)	35	804	10	322	35	2,272	1	1,300	-	-
	24	5,200	50	1,400	25	24,000	1,300	1,300	-	-
Dissolved iron as Fe (µg/l)	15	615	8	488	19	221	18	732	18	626
	210	930	280	750	10	780	210	1200	60	1,000
Total iron as Fe (µg/l)	8	773	7	564	11	478	7	771	7	567
	300	1,200	420	790	130	1,200	440	1,200	100	1,200
Dissolved lead as Pb (µg/l)	15	5	7	8	17	3	17	3	16	5
	0	12	4	16	0	10	0	12	0	16
Total manganese as Mn (µg/l)	8	29	7	21	11	25	7	17	7	20
	10	43	10	40	10	70	10	30	10	30
Total mercury as Hg (µg/l)	9	0.1	7	0.2	11	0.1	7	0.3	7	0.3
	0	0.5	0	0.5	0	0.5	0.1	0.5	0.1	0.5

[1]Number of samples analyzed
[2]Mean
[3]Minimum
[4]Maximum

Source: Coffin 1982.

Summary USGS Data for Selected Sites in the Suwannee River Basin, Florida, November 1968 to December 1980.

Parameter	Station 02315500		02315520		02315532		02315542		02315550	
Flow (cfs)	59[1]	1,777[2]	78	86	14	13	13	1.8	72	2,227
	20[3]	11,500[4]	7.5	1,180	0	56	0	10	91	11,300
Conductivity (µmhos/cm)	58	53	79	500	11	52	9	110	73	106
	31	135	133	900	42	65	55	180	39	390
pH, field	59	4.7	80	6.1	11	4.9	9	6.0	73	5.8
	3.3	7.4	3.7	7.1	4.5	5.5	4.6	6.8	3.6	7.5
Dissolved fluoride as F (mg/l)	58	0.2	80	6.7	11	0.2	9	0.2	70	0.5
	0	0.8	2.0	29	0.1	0.5	0.2	0.3	0	2.0
Total phosphorus as P (mg/l)	54	0.153	77	18.327	11	0.282	9	0.268	59	1.204
	0.050	0.380	1.500	42.000	0.140	0.410	0.090	0.580	0.120	6.900
Orthophosphate as P (mg/l)	56	0.143	74	17.394	11	0.265	9	0.230	67	1.027
	0.050	0.370	1.300	42.000	0.130	0.410	0.080	0.450	0.120	6.900
Temperature, field (°C)	58	20.5	80	20.3	11	18.4	9	17.2	73	20.4
	6.5	29.5	7.0	29.0	6.0	28.0	8.5	26.0	7.0	29.0
Dissolved oxygen (mg/l)	51	7.5	73	5.5	11	8.2	9	7.0	66	7.1
	4.3	11.8	2.8	10.8	5.9	13.7	4.3	11.2	4.4	11.5
Dissolved oxygen (% sat.)	44	81	61	57	11	82	9	69	57	76
	64	113	34	100	67	109	46	96	47	96
BOD_5 (mg/l)	22	0.9	67	4.9	10	0.9	9	1.3	68	1.1
	0.1	5.2	0.4	10	0.3	1.2	0.6	1.8	0.2	5.5
Turbidity (JTU)	36	11	60	15	-	-	-	-	52	9
	1	110	3	62	-	-	-	-	1	95
Total ammonia as N (mg/l)	48	0.055	71	5.636	11	0.017	9	0.017	59	0.192
	0	0.230	0.010	23.000	0	0.050	0	0.040	0.010	1.400
Total nitrate as N (mg/l)	57	0.03	77	1.9	11	0.04	9	0	66	0.20
	0	0.27	0.01	6.3	0	0.14	0	0.03	0	1.50
Total nitrite as N (mg/l)	55	0.015	77	0.152	11	0.016	9	0.016	66	0.022
	0	0.030	0	1.900	0.010	0.020	0.010	0.030	0.010	0.110
Total organic nitrogen as N (mg/l)	48	0.79	72	1.2	11	0.91	9	1.1	64	0.74
	0.16	1.4	0	7.9	0.50	1.3	0.40	1.9	0.11	1.8
Total organic carbon as C (mg/l)	16	33	72	19	10	30	7	47	61	29
	14	63	0	52	23	54	18	84	6.8	50
Total coliform (cols./100 ml)	9	1,402	39	7,303	-	-	-	-	43	827
	100	3,900	100	166,000	-	-	-	-	28	9,200
Dissolved iron as Fe (µg/l)	21	464	24	160	1	1,400	1	1,100	15	407
	230	810	10	440	1,400	1,400	1,100	1,100	110	810
Total iron as Fe (µg/l)	14	568	15	571	1	1,500	1	1,100	11	542
	360	950	190	1,000	1,500	1,500	1,100	1,100	170	940
Dissolved lead as Pb (µg/l)	18	4	22	4	1	1	1	1	13	1
	0	17	0	20	1	1	1	1	0	6
Total manganese as Mn (µg/l)	15	42	15	69	1	40	1	80	11	20
	10	300	40	120	40	40	80	80	10	30
Total mercury as Hg (µg/l)	17	0.1	18	0.1	1	0.5	1	0.5	12	0.1
	0	0.7	0	0.5	0.5	0.5	0.5	0.5	0	0.5

[1]Number of samples analyzed
[2]Mean
[3]Minimum
[4]Maximum

Source: Coffin 1982.

Summary USGS Data for Selected Sites in the Suwannee River Basin, Florida, November 1968 to December 1980.

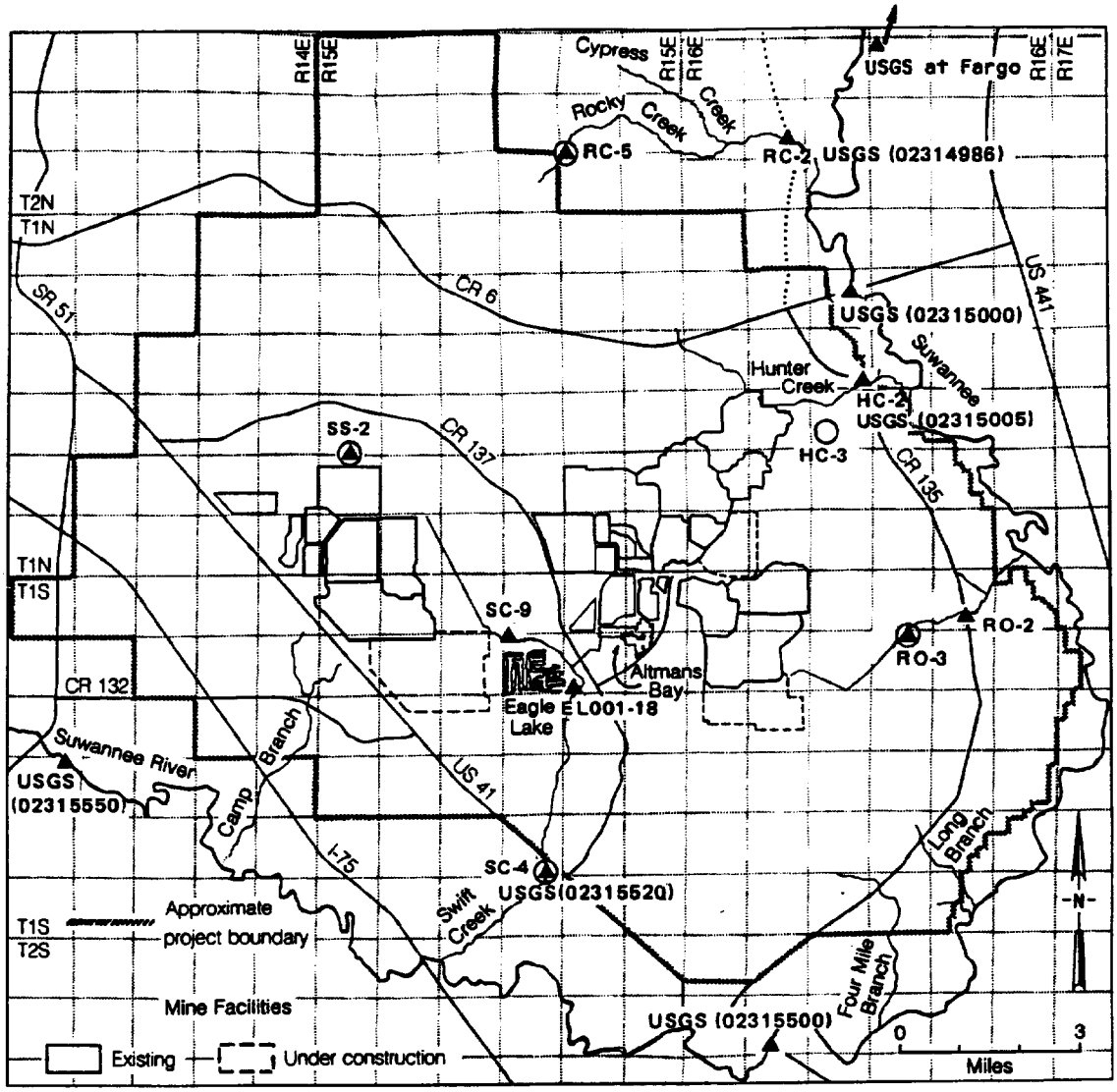
Parameter	Station 02319000		02320500		02321500		02323500	
Flow (cfs)	121[1]	2,175[2]	160	7,288	47	380	73	10,594
	93[3]	21,500[4]	1,600	43,300	11	2,600	3,610	25,700
Conductivity (µmhos/cm)	101	168	136	195	78	92	65	219
	25	510	37	380	28	235	56	360
pH, field	88	6.8	123	7.1	65	6.3	68	7.2
	4.5	8.3	5.1	8.2	5.0	8.0	5.0	8.4
Dissolved fluoride as F (mg/l)	84	0.3	122	0.2	58	0.2	59	0.2
	0	1.9	0	0.7	0.1	0.8	0	1.0
Total phosphorus as P (mg/l)	75	0.191	115	0.246	50	0.264	57	0.184
	0.060	1.100	0.095	1.300	0.033	1.000	0.090	0.450
Orthophosphate as P (mg/l)	103	0.185	114	0.208	61	0.194	64	0.163
	0.049	0.780	0.050	1.000	0.030	0.430	0.020	0.330
Temperature, field (°C)	112	19.4	144	20.2	94	20.9	68	20.8
	6.5	29.0	7.5	28.0	7.0	29.0	8.0	28.0
Dissolved oxygen (mg/l)	68	6.0	101	6.5	48	6.4	66	6.6
	2.7	11.5	3.5	10.2	3.2	10.2	3.9	10.4
Dissolved oxygen (% sat.)	58	63	67	70	22	65	57	72
	32	100	40	88	38	81	42	98
BOD_5 (mg/l)	65	1.5	68	0.8	20	1.1	63	0.8
	0.3	4.2	0	3.1	0	8.0	0	2.1
Turbidity (JTU)	71	11	90	5	42	8	50	6
	1	49	1	20	1	50	1	29
Total ammonia as N (mg/l)	71	0.064	111	0.047	45	0.041	54	0.034
	0.010	0.440	0	0.800	0	0.180	0	0.090
Total nitrate as N (mg/l)	69	0.21	87	0.36	28	0.09	54	0.35
	0	0.64	0	1.0	0	0.43	0	0.84
Total nitrite as N (mg/l)	68	0.018	82	0.014	27	0.013	54	0.011
	0.008	0.050	0	0.090	0.007	0.030	0	0.030
Total organic nitrogen as N (mg/l)	83	0.64	118	0.44	53	0.80	62	0.41
	0.10	2.2	0	1.4	0.27	2.1	0	2.9
Total organic carbon as C (mg/l)	58	14	83	14	24	23	57	12
	6.5	26	0	33	8.0	43	0	36
Total coliform (cols./100 ml)	42	3,300	38	478	3	17,717	32	509
	0	69,000	25	3,800	1,350	40,000	70	4,800
Dissolved iron as Fe (µg/l)	23	283	44	225	25	301	14	176
	30	770	0	570	80	700	0	480
Total iron as Fe (µg/l)	15	888	29	480	17	467	10	446
	120	1,500	80	1,000	170	780	100	810
Dissolved lead as Pb (µg/l)	17	6	34	5	21	4	13	3
	0	20	0	27	0	24	0	13
Total manganese as Mn (µg/l)	15	34	31	23	18	23	10	23
	20	50	10	60	10	50	10	40
Total mercury as Hg (µg/l)	17	0.1	34	0.2	20	0.1	11	0.2
	0	0.5	0	1.7	0	0.5	0	0.5

[1]Number of samples analyzed
[2]Mean
[3]Minimum
[4]Maximum

Source: Coffin 1982.

APPENDIX A.3

SAMPLING STATION LOCATION MAPS

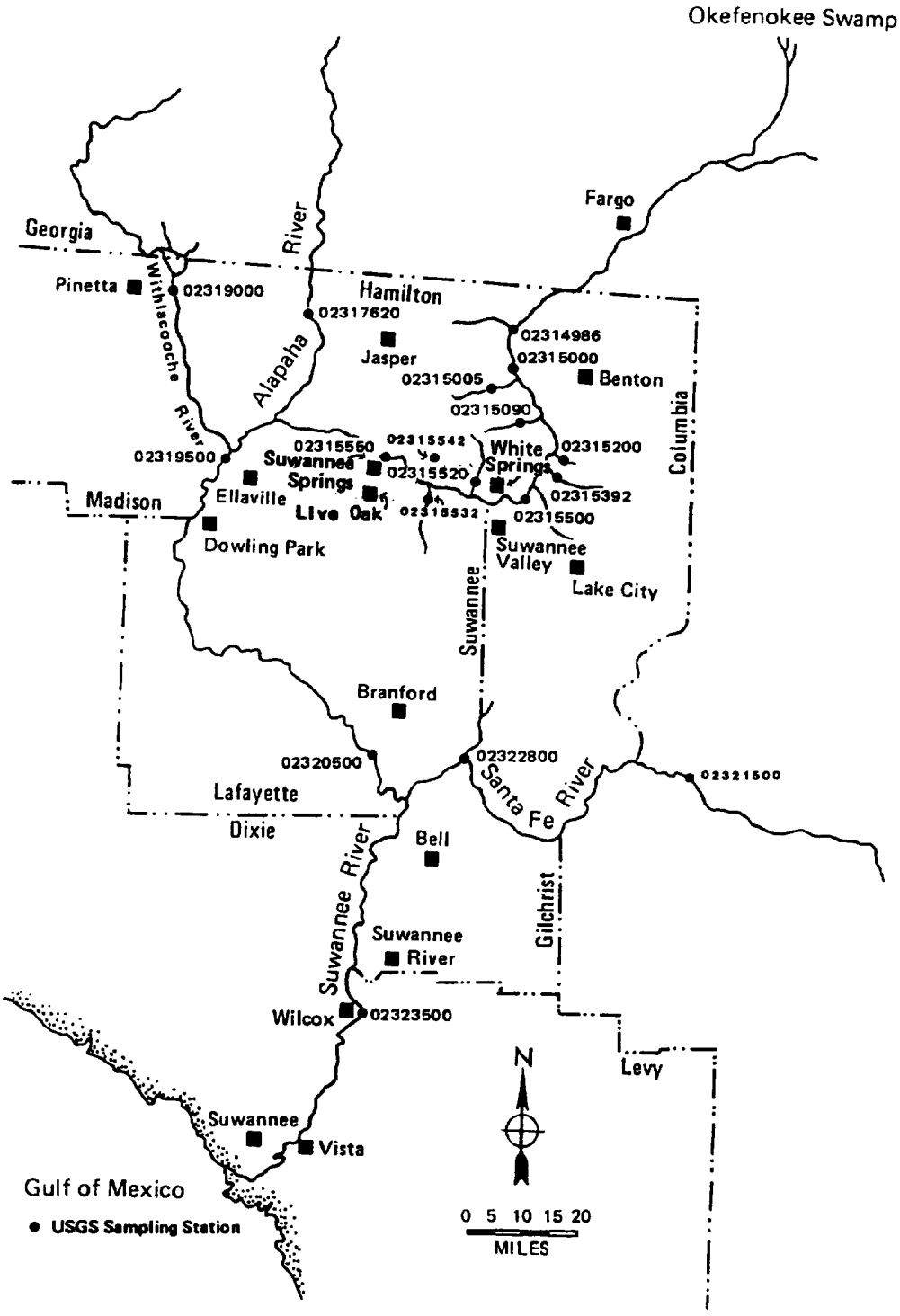


NOTE: Does not reflect all areas affected by mining or mine support activities. See Figure 1.1-2.

▲ Daily flow and/or stage station

○ Rainfall station

Rainfall Stations and Daily Flow and/or Stage Stations



Location of USGS Water Quality Sampling Stations in the Suwannee River Drainage Basin

APPENDIX B

ARCHAEOLOGICAL ARTIFACTS

Notes:

Arranged by site provenience.

For ceramics, figures in parentheses denote rim sherds included.

For lithics, figures in parentheses denote thermally altered specimens included.

See map on page B-23 for locations of archaeological sites.

8Ha62

F.S.01 General Surface Collection

Lithics

Unutilized	8(2)	chert primary decortication flakes.
	37(32)	chert secondary decortication flakes.
	73(52)	chert nondecortication flakes.
Utilized	2(2)	chert chipped-stone projectile points. Type--Florida Archaic Stemmed, subtype--Marion (Bullen 1968:29).
	1(1)	chert chipped-stone projectile point preform. Type--unidentified.
	2(1)	chert bifacial scrapers ovoid in shape with fine marginal retouch on several edges.
	1(1)	chert secondary decortication flake utilized as end scraper with fine marginal retouch and use wear on several edges.
	1(1)	chert narrow trapezoidal scraper (Griffin 1974:48-49).
	1(1)	chert unifacial scraper with proximal and distal ends absent.
	10(6)	chert secondary decortication flakes with fine marginal retouch along one lateral edge.
	2(2)	chert nondecortication flakes with fine marginal retouch on one lateral edge.
	4(3)	chert nondecortication flakes with fine marginal retouch on several edges.
	1(1)	porous stone abrader (possibly limestone).

Total = 143

Ceramics	2(0)	Swift Creek Complicated Stamped.
	1(0)	unidentified incised (eroded) with straight line incision.
	6(1)	sand-tempered plain, rim simple.
	3(0)	grit-tempered plain.

Total = 12

8Ha65

F.S.01 General Surface Collection

Lithics

Unutilized	1(0)	chert blocky fragment.
Utilized	1(0)	chert secondary decortication flake with fine marginal retouch on several edges.
Total =	2	

F.S.02 Test Unit 7N/13W Level 1 (0-15 cm below surface)

Lithics

Unutilized	1(1)	chert secondary decortication flake.
	3(1)	chert nondecortication flakes.
Total =	4	

Ceramics

	1(0)	sand-tempered plain.
Total =	1	

Historic

Ceramics

	1(1)	ironstone.
	1(0)	Salt-glazed stoneware crock fragment.
Total =	2	

Glass

	1	green glass fragment, embossed with letter "A".
	1	clear glass fragment.
Total =	2	

Metal

	1	brass cut nail with rectangular shank.
Total =	1	

F.S.03 Test Unit 7N/13W Level 2 (15-30 cm below surface)

Lithics

Unutilized	2(2)	chert secondary decortication flakes.
	6(6)	chert nondecortication flakes.
Utilized	1(1)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--Putnam (Bullen 1968:29).

Total = 9

Ceramics

	1(0)	sand-tempered plain.

Total = 1

F.S.04 Test Unit 7N/13W Level 3 (30-45 cm below surface)

Lithics

Unutilized	1(0)	chert primary decortication flake.
	1(1)	chert secondary decortication flake.
	4(1)	chert nondecortication flakes.

Total = 6

F.S.05 Test Unit 7N/13W Level 4 (45-60 cm below surface)

Lithics

Unutilized	1(0)	chert primary decortication flake.
	3(3)	chert secondary decortication flakes.
	3(2)	chert nondecortication flakes.

Total = 7

Faunal

Unutilized	1	unidentified animal bone fragment.

Total = 1

F.S.06 Test Unit 7N/13W Level 5 (60-75 cm below surface)

Lithics

Unutilized	1(1)	chert secondary decortication flake.

Total = 1

F.S.07 Test Unit 62S/50E Level 2 (15-30 cm below surface)

Lithics

Unutilized	2(2)	chert secondary decortication flakes.
	2(2)	chert nondecortication flakes.
Total =	4	

F.S.08 Test Unit 62S/50E Level 3 (30-45 cm below surface)

Lithics

Unutilized	4(4)	chert nondecortication flakes.
Total =	4	

F.S.09 Test Unit 62S/50E Level 4 (45-60 cm below surface)

Lithics

Unutilized	5(4)	chert nondecortication flakes.
Total =	5	

F.S.10 Test Unit 62S/50E Level 5 (60-75 cm below surfce)

Lithics

Unutilized	3(2)	chert nondecortication flakes.
Total =	3	

8Ha66

F.S.01 Area A General Surface Collection

Lithics

Unutilized	1(1)	chert primary decortication flake.
	5(4)	chert secondary decortication flakes.
	10(6)	chert nondecortication flakes.
Total =	16	

F.S.02 Area B general surface collection

Lithics

Unutilized	4(1)	chert secondary decortication flakes.
	27(7)	chert nondecortication flakes.
	1(1)	chert blocky fragment.

Utilized	1(1)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed (Bullen 1968:72), subtype--unidentified.
	1(1)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--unidentified (distal end absent).
	1(0)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--Alachua (Bullen 1968:29).
	1(1)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--unidentified (distal end absent).
	1(1)	chert secondary decortication flake with fine marginal retouch on one edge.
	1(1)	chert nondecortication flake with fine marginal retouch on three edges. Possible end scraper or unifacial blade.

Total = 38

Ceramics

	4(0)	unidentified (eroded) decorated. Possibly Prairie Cord Marked.
	3(0)	unidentified (eroded) incised. (Alachua Tradition?).
	1(0)	sand-tempered plain.

Total = 8

8Ha67

F.S.01 General Surface Collection

Lithics

Unutilized	3(0)	chert primary decortication flakes.
	35(6)	chert secondary decortication flakes.
	121(9)	chert nondecortication flakes.
	4(2)	chert blocky fragments.
Utilized	1(0)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--Levy (Bullen 1968:29).
	1(0)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--unidentified (similar to Putnam). (Bullen 1968:29).
	1(0)	chert chipped-stone projectile point base. Type--Florida Archaic Stemmed (Bullen 1968:29), subtype--unidentified (distal and proximal portions absent).

1(0) chert bifacial fragment with steep marginal retouch on one lateral edge.
1(0) chert secondary decortication flake with fine marginal retouch on one edge.
2(0) chert nondecortication flakes with fine marginal retouch on two edges.

Total = 170

Ceramics

1(0) unidentified (eroded) decorated. Possibly Prairie Cord Marked.
20(3) sand-tempered plain, rims simple, folded.

Total = 21

8Ha69

F.S.01 General Surface Collection

Lithics

Unutilized
2(2) chert primary decortication flakes.
4(1) chert secondary decortication flakes.
10(7) chert nondecortication flakes.
3(2) chert blocky fragments.

Utilized
2(1) chert chipped-stone projectile point distal end fragments. Types--unidentified. Blade shapes suggest possible Archaic types.

Total = 21

Ceramics
1(0) sand-tempered plain.

Total = 1

8Ha70

F.S.01 General Surface Collection

Lithics

Unutilized
34(7) chert secondary decortication flakes.
71(20) chert nondecortication flakes.
5(2) chert blocky fragments.

Utilized
1(0) chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--Levy (Bullen 1968:29)

	1(0)	chert chipped-stone projectile point. Point is corner notched with straight base and distal end reworked as hafted scraper. Type--unidentified, but similar to Clay or Lafayette (Bullen 1968:26-27).
	1(0)	chert bifacial blade or scraper with fine marginal retouch on one lateral edge.
	1(0)	chert unifacial blade fragment with fine marginal retouch along both lateral edges.
	1(0)	chert nondecortication flake with fine marginal retouch on one edge.
	2(0)	chert hammerstones showing edge battering.

Total = 117

8Ha71

F.S.01 General Surface Collection

Lithics

Unutilized	7(3)	chert secondary decortication flakes.
	29(7)	chert nondecortication flakes.
Utilized	1(0)	chert secondary decortication flake showing fine marginal retouch.

Total = 37

Ceramics

	2(1)	sand-tempered plain, rim simple.

Total = 2

F.S.02 Test Unit 65N/10W Level 1 (0-15 cm below surface)

Lithics

Unutilized	1(1)	chert secondary decortication flake.

Total = 1

Ceramics

	1(0)	sand-tempered plain.

Total = 1

Historic

Glass

	2	fragments (1 green, 1 clear).
Total =	2	

Ceramics

	1	kaolin pipe bowl fragment, burned.
Total =	1	

F.S.03 Test Unit 65N/10W Level 2 (15-30 cm below surface)

Lithics

Utilized	1	bifacial tool fragment, type undetermined (broken).
Total =	1	

Ceramics

	4(1)	sand-tempered plain, rim simple.
Total =	4	

F.S.04 Test Unit 65N/10W Level 3 (30-45 cm below surface)

Lithics

Unutilized	3(1)	chert nondecortication flakes.
Total =	3	

Ceramics

	2(0)	sand-tempered plain.
Total =	2	

F.S.05 Test Unit 65N/10W Level 4 (45-60 cm below surface)

Lithics

Unutilized	1(0)	chert nondecortication flake.
Total =	1	

Ceramics

4(0) sand-tempered plain.

Total = 4

F.S.06 Test Unit 65N/10W Level 5 (60-75 cm below surface)

Lithics

Unutilized 1(0) chert secondary decortication flake.

Total = 1

Ceramics

1(0) sand-tempered plain.

Total = 1

F.S.07 Test Unit 65N/10W Level 6 (75-90 cm below surface)

Ceramics

1(1) Weeden Island Plain incised rim.

Total = 1

F.S.08 Test Unit 25S/15E Level 1 (0-15 cm below surface)

Lithics

Unutilized 2(2) chert secondary decortication flakes.

Total = 2

F.S.09 Test Unit 25S/15E Level 2 (15-30 cm below surface)

Ceramics

2(0) sand-tempered plain.

Total = 2

F.S.10 Test Unit 25S/15E Level 4 (45-60 cm below surface)

Lithics

Unutilized 1(0) chert secondary decortication flake.

Total = 1

Ceramics

1(0) sand-tempered plain.

Total = 1

F.S.11 Test Unit 25S/15E Level 5 (60-75 cm below surface)

Ceramics

1(0) sand-tempered plain.

Total = 1

8Ha72

F.S.01 General Surface Collection

Lithics

Unutilized	4(0)	chert nondecortication flakes.
Utilized	1(1)	chert chipped-stone projectile point distal fragment. Type--unidentified.
	1(0)	chert nondecortication flake with fine marginal retouch on one lateral edge.

Total = 6

8Ha73

F.S.01 General Surface Collection

Lithics

Unutilized	5(2)	chert primary decortication flakes.
	51(24)	chert secondary decortication flakes.
	172(44)	chert nondecortication flakes.
	4(1)	chert blocky fragments.
Utilized	1(1)	chert chipped-stone projectile point. Type--Taylor or Jackson (Bullen 1975).
	1(1)	chert chipped-stone projectile point. Type--Taylor or Jackson (Bullen 1975).
	3(3)	chert chipped-stone projectile points. Type--Pinellas (Bullen 1975:12).
	8(8)	chert chipped-stone projectile point or bifacial scraper fragments (medial, distal and proximal fragments). Types--unidentified (broken).

1(1) chert chipped-stone projectile point with stemmed base. Type--unidentified (distal end absent).
9(5) chert chipped-stone projectile point preforms or blanks in various stages of completion. One preform shows use wear striations (possible knife?).
16(1) chert nondecortication flakes with fine marginal retouch on one edge.
10(3) chert nondecortication flakes with fine marginal retouch on several edges.

Total = 281

Ceramics

2(0) Carabelle Punctate.
2(0) Wakulla Check Stamped.
1(0) sand-tempered; Red Filmed. Type--Weeden Island Red Filmed.
1(1) Plain incised rim. Type--Weeden Island Plain.
2(2) Lake Jackson style rims with nodes. Type--unidentified (Alachua series).
80(7) sand-tempered plain (eroded), all rims simple.
3(0) grit-tempered plain (eroded).
2(0) grog (sherd) tempered plain.

Total = 93

F.S.02 Test Unit 15S/21E Level 1 (0-15 cm below surface)

Lithics

Unutilized
8(5) chert secondary decortication flakes.
17(6) chert nondecortication flakes.
3(2) chert primary decortication flakes.

Total = 28

Ceramics

5(1) sand-tempered plain, rim simple.
1(0) grit-tempered plain.
1(0) sand-tempered stamped. Type--unidentified (eroded), possibly Swift Creek Complicated Stamped.

Total = 7

F.S.03 Test Unit 11S/21E Level 2 (15-30 cm below surface)

Lithics

Unutilized	1(1)	chert primary decortication flake.
	4(4)	chert secondary decortication flakes.
	19(7)	chert nondecortication flakes.

Total = 24

Ceramics

	9(1)	sand-tempered plain, rim simple.

Total = 9

F.S.04 Test Unit 11S/21E Level 3 (30-45 cm below surface)

Lithics

Unutilized	1(0)	chert primary decortication flake.
	4(4)	chert secondary decortication flakes.
	16(7)	chert nondecortication flakes.

Total = 21

Ceramics

	3(0)	sand-tempered plain.

Total = 3

F.S.05 Test Unit 11S/21E Level 4 (45-60 cm below surface)

Lithics

Unutilized	2(2)	chert secondary decortication flakes.
	5(3)	chert nondecortication flakes.

Total = 7

F.S.06 Test Unit 11S/21E Level 5 (60-75 cm below surface)

Lithics

Unutilized	2(2)	chert secondary decortication flakes.
	2(1)	chert nondecortication flakes.

Total = 4

Ceramics

3(0) sand-tempered plain.

Total = 3

F.S.07 Test Unit 20N/10E Level 1 (0-15 cm below surface)

Lithics

Unutilized
2(2) chert secondary decortication flakes.
3(2) chert nondecortication flakes.

Total = 5

Ceramics

4(1) sand-tempered plain, rim simple.

Total = 4

F.S.08 Test Unit 20N/10E Level 2 (15-30 cm below surface)

Lithics

Unutilized
3(2) chert secondary decortication flakes.
3(2) chert nondecortication flakes.

Total = 6

Ceramics

1(0) sand-tempered plain.

Total = 1

F.S.09 Test Unit 20N/10E Level 3 (30-45 cm below surface)

Ceramics

1(1) sand-tempered plain rim, folded. Type--possibly Weeden Island.

Total = 1

F.S.10 Test Unit 20N/10E Level 4 (45-60 cm below surface)

Lithics

Unutilized
1(1) chert nondecortication flake.

Total = 1

F.S.11 Test Unit 20N/10E Level 5 (60-70 cm below surface)

Ceramics

2(0) sand-tempered plain.

Total = 2

F.S.12 Test Unit 20N/10E Level 6 (75-90 cm below surface)

Lithic

Unutilized 1(0) chert primary decortication flake.

Total = 1

F.S.13 Test Unit 157N/33E Level 1 (0-15 cm below surface)

Lithics

Unutilized 4(3) chert secondary decortication flakes.
5(4) chert nondecortication flakes.

Utilized 1(1) chert chipped-stone projectile point. Type--Pinellas (Bullen 1975:12).

Total = 10

Ceramics

15(1) sand-tempered plain, simple rim.
1(0) grit-tempered plain.

Total = 16

F.S.14 Test Unit 157N/33E Level 2 (15-30 cm below surface)

Lithics

Unutilized 3(0) chert primary decortication flakes.
9(5) chert secondary decortication flakes.
8(3) chert nondecortication flakes.

Total = 20

Ceramics

15(0) sand-tempered plain.
1(0) sand-tempered, stamped. Type--unidentified (eroded).

Total = 16

F.S.15 Test Unit 157N/33E Level 3 (30-45 cm below surface)

Lithics

Unutilized	3(3)	chert secondary decortication flakes.
	5(4)	chert nondecortication flakes.
Utilized	1(1)	chert nondecortication flake showing fine marginal retouch on two edges.

Total = 9

Ceramics

7(1)	sand-tempered plain. Type--possibly Weeden Island.

Total = 7

F.S.16 Test Unit 157N/33E Level 4 (45-60 cm below surface)

Lithics

Unutilized	1(1)	chert secondary decortication flake.
	2(2)	chert nondecortication flakes.

Total = 3

Ceramics

8(2)	sand-tempered plain, rims simple.

Total = 8

F.S.17 Test Unit 157N/33E Level 5 (60-75 cm below surface)

Ceramics

4(0)	sand-tempered plain.

Total = 4

F.S.18 Test Unit 157N/33E Level 6 (75-90 cm below surface)

Ceramics

2(0)	sand-tempered plain.
1(0)	sand-tempered red filmed. Type--Weeden Island Red Filmed.

Total = 3

8Ha74

F.S.01 General Surface Collection

Lithics

Unutilized	3(2)	chert secondary decortication flakes.
	7(2)	chert nondecortication flakes.
	2(0)	chert blocky fragments.

Total = 12

8Ha75

F.S.01 General Surface Collection

Lithics

Unutilized	1(0)	chert secondary decortication flake.
	3(2)	chert nondecortication flakes.
Utilized	1(0)	chert bifacial fragment.

Total = 5

8Ha76

F.S.01 General Surface Collection

Lithics

Unutilized	2(0)	chert nondecortication flakes.

Total = 2

8Ha77

F.S.01 General Surface Collection

Historic

Ceramics

5(0)	salt-glazed stoneware with 2 base fragments, brown exterior.
20(8)	pearlware, blue transfer printed (including 4 rims and 2 base fragments).
15(5)	pearlware, red transfer printed (including 3 base fragments).
1(0)	pearlware, purple transfer printed.

	1(0)	pearlware, brown (base fragment).
	3(2)	pearlware, banded (1 blue on yellow, 2 tan and brown rims).
	2(0)	pearlware, blue, handpainted ("Gaudy Dutch").
	2(2)	pearlware, green, molded.
	10(0)	pearlware, blue, shell-edged.
	17(0)	pearlware, plain white (including 5 bases; one base has rosette shaped maker's mark).
	3(1)	white ironstone (including 1 cup handle with gold leaf lined rim).
	3	kaolin pipe stem fragments, 1 decorated.
	3	kaolin pipe bowl fragments, decorated.
Total =	85	

Glass

	7	green glass bottle fragments (including 3 base fragments with kickup on base).
	2	clear glass fragments (including 1 handblown base fragment).
Total =	9	

Metal

	1	brass cut square nail.
Total =	1	

Lithic

	1	honey-colored gun flint.
Total =	1	

F.S.02 Test Excavation Unit Level 1 (0-15 cm below surface)

Aboriginal

Lithic

Unutilized	1(0)	chert nondecortication flake.
Total =	1	

Ceramic

1(0) sand-tempered plain.

Total = 1

Historic

Ceramics

1(0) pearlware, sponged red.
1(0) refined earthenware. Type--unidentified (burned).

Total = 2

8Ha78

F.S.01 General Surface Collection

Historic

Glass

3 green bottle glass fragments (including 1 base).
1 clear, molded (bottle fragment?).

Total = 4

Metal

1 iron fragment.

Total = 1

Brick

7 red brick fragments.

Total = 7

Mortar

4 fragments.

Total = 4

Faunal

1 unidentified (eroded) animal long bone fragment.

Total = 1

8Ha79

F.S.01 General Surface Collection

Lithics

Unutilized	4(2)	chert primary decortication flakes.
	19(12)	chert secondary decortication flakes.
	99(23)	chert nondecortication flakes.
	1(1)	chert blocky fragment.
Utilized	2(1)	chert chipped-stone projectile points. Type--Pinellas (Bullen 1968:12).
	1(1)	chert chipped-stone projectile point. Type--Florida Archaic Stemmed, subtype--Levy (Bullen 1968:29).
	1(1)	chert chipped-stone drill (Griffin 1974:50, Figure 33-0).
	1(1)	chert chipped-stone projectile point preform.
	3(1)	chert bifacial tool fragments. Types--unidentified (broken).
	2(2)	chert secondary decortication flakes with fine marginal retouch on several edges.
	7(5)	chert nondecortication flakes with fine marginal retouch on several edges.

Total = 140

Ceramics

2(0)	Swift Creek Complicated Stamped.
1(0)	Carrabelle Punctate.
1(1)	Wakulla Check Stamped, rim simple.
20(0)	sand-tempered plain.

Total = 24

8Ha80

F.S.01 General Surface Collection

Lithics

Unutilized	3(3)	chert primary decortication flakes.
	23(7)	chert secondary decortication flakes.
	100(17)	chert nondecortication flakes.
Utilized	2(2)	chert secondary decortication flakes with fine marginal retouch on several edges.
	1(1)	chert chipped-stone projectile point distal fragment. Type--unidentified.
	1(1)	chert bifacial fragment.

3(3) chert nondecortication flakes with fine marginal retouch on several edges.

Total = 133

8Ha81

F.S.01 General Surface Collection

Lithics

Unutilized
4(2) chert secondary decortication flakes.
9(4) chert nondecortication flakes.

Utilized
2(0) chert hammerstones showing edge battering.
2(1) chert nondecortication flakes showing fine marginal retouch on several edges.

Total = 17

Ceramics

1(0) Lochloosa Punctate.

Total = 1

Historic

Ceramics

2(0) salt-glazed stoneware.
1(0) pearlware, plain white.
1(1) pearlware, blue shell-edged.
1(0) pearlware, handpainted ("Gaudy Dutch").
2(1) ironstone.

Total = 7

8Ha82

F.S.01 General Surface Collection

Lithics

Unutilized
7(3) chert secondary decortication flakes.
9(4) chert nondecortication flakes.

Utilized
1(0) chert nondecortication flake with fine marginal retouch on one lateral edge.

Total = 17

Ceramics

1(0) Punctate. Type--Weeden Island.
6(0) Sand-tempered plain.

Total = 7

8Ha83

F.S.01 General Suface Collection

Lithics

Unutilized
13(6) chert secondary decortication flakes.
35(12) chert nondecortication flakes.

Utilized
1(1) chert chipped-stone projectile point preform.
2(2) chert nondecortication flakes with fine marginal retouch on several edges.

Total = 51

Ceramics

1(1) Deptford Simple Stamped, rim simple.
11(1) sand-tempered plain, rim simple.

Total = 12

8Ha84

F.S.01 General Surface Collection

Lithics

Unutilized
1(1) chert secondary decortication flake.
2(1) chert nondecortication flakes.
1(0) smooth, water worn dark grey chert core with single percussion flake removed.

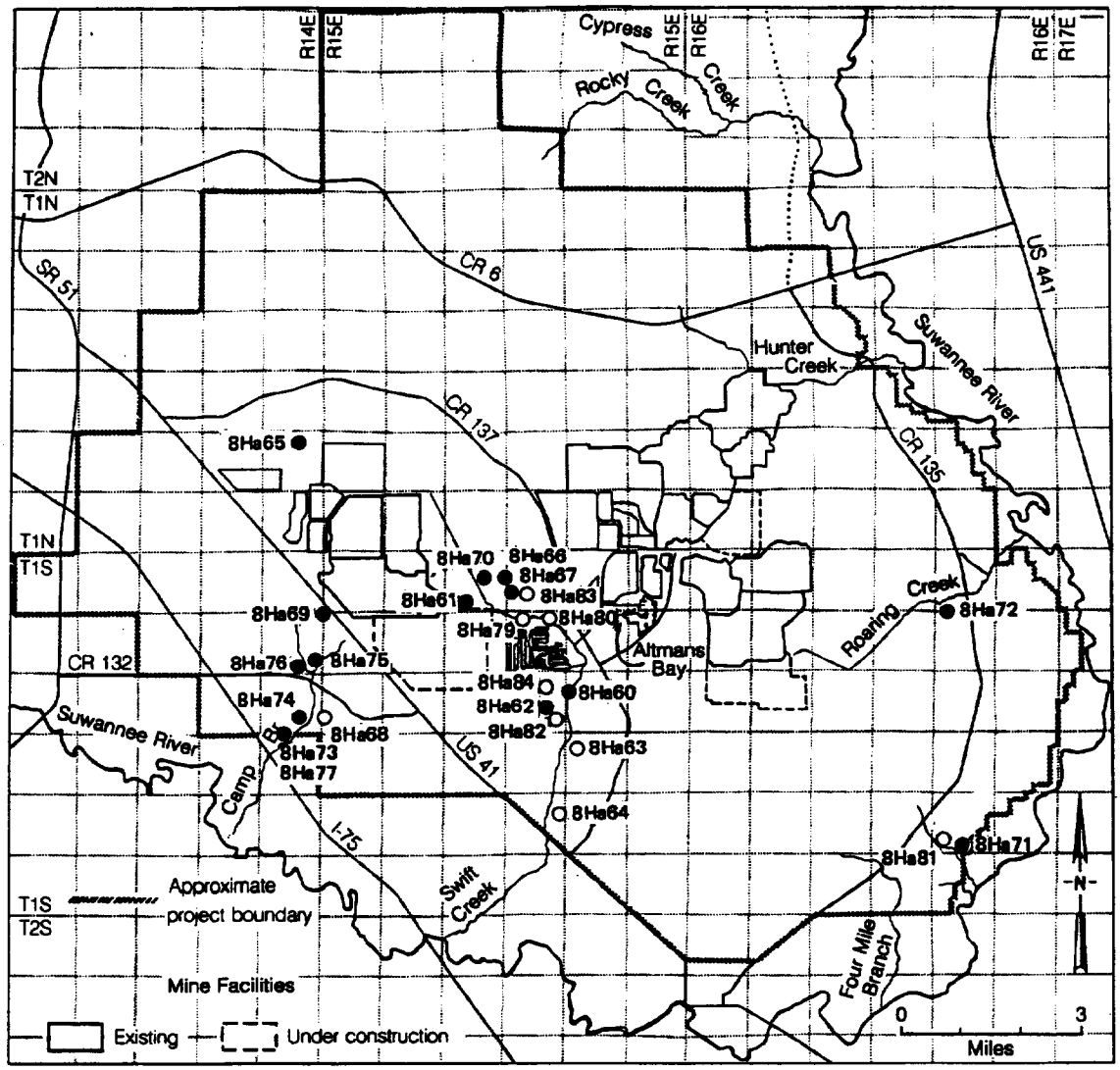
Utilized
1(1) chert bifacial fragment. Type--unidentified.
1(1) chert nondecortication flake with fine marginal retouch.

Total = 6

Ceramics

3(0) sand-tempered plain.

Total = 3



NOTE: Does not reflect all areas affected by mining or mine support activities. See Figure 1.1-2.

● Sites within proposed mining area
○ Sites outside proposed mining area

Note: Sites 8Ha79 through 8Ha84 were found outside the FDAHRM high probability designated areas.

Archaeological Sites

APPENDIX C

WETLANDS EVALUATION

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF TABLES
(continued)

LIST OF TABLES
(continued)

LIST OF TABLES
(continued)

LIST OF FIGURES

APPENDIX C

WETLANDS EVALUATION

Selected wetlands typical of those types and sizes within the project area were evaluated using two basic wetlands evaluation methodologies: 1) a modified version of the Wetlands Evaluation Procedure (WEP) developed by the U.S. Army Corps of Engineers (Reppert et al. 1979) and 2) the Method for Wetland Functional Assessment developed for the Federal Highway Administration (Adamus 1983).

The WEP was selected because it is based on physical, biological, and human use characteristics of wetlands as well as functional attributes which have been discussed in the scientific literature and recognized in Section 404 of the Clean Water Act (Public Law 92-500, as amended), President Carter's May 24, 1977 Executive Order on wetlands protection, and other statutory and administrative authorities. The procedure also provides specific criteria for determining the efficiency with which a wetland performs specified functions (Table C.0-1) and integrates the relative importance of the various criteria by assigning a numerical score for each function.

Additionally, the WEP system meets the critical elements of measurement considered important in assessment of functional values for wetland evaluation systems by the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi (Lonard et al. 1981). Of approximately 41 wetlands assessment methodologies evaluated by Lonard et al. (1981), 20 contained relevant evaluation methodologies for one or more of the following critical elements of wetlands functional values:

- habitat
- hydrology
- recreation
- agriculture/silviculture
- heritage

Of the 20 evaluation procedures, only the following three procedures addressed all five of the critical elements identified by Lonard et al. (1981):

- WEP (Reppert et al. 1979);
- Charles River (U.S. Army Engineer Division, New England 1972); and,
- Wetlands Evaluation Criteria--Water and Related Land Resources of the Coastal Region, Massachusetts (USDA 1978).

Lonard et al. (1981) reported the latter two as limited in their geographical applicability and/or use for inland and coastal areas. WEP,

Table C.0-1. Functions Considered in the Wetlands Evaluation Procedure as Outlined by Reppert et al. (1979).

Parameter	Hierarchical Category
I. NATURAL BIOLOGICAL FUNCTIONS	FUNCTION
A. Food Chain Production	Subfunction
1) Net primary productivity	Component
2) Mode of detrital transport	Component
3) Food chain support	Component
B. General and Specialized Habitat	Subfunction
1) Abiotic and biotic characteristics	Component
2) Evaluation of usage by selected species	Component
II. AQUATIC STUDY AREAS, SANCTUARIES, REFUGES	FUNCTION
III. HYDROLOGIC SUPPORT FUNCTION	FUNCTION
A. Hydrologic Periodicity	Subfunction
B. Location or Elevation within Wetland System	Subfunction
IV. SHORELINE PROTECTION	FUNCTION
V. STORAGE FOR STORM AND FLOOD WATERS	FUNCTION
A. Flood Storage	Subfunction
B. Flood Retardation	Subfunction
VI. NATURAL GROUNDWATER RECHARGE	FUNCTION
VII. WATER PURIFICATION THROUGH NATURAL WATER FILTRATION	FUNCTION
A. Wetland Type	Subfunction
1) Hydroperiod	Component
2) Vegetation density	Component
B. Areal and Waste-Loading Relationships	Subfunction
1) Total wetland size	Component
2) Proportion of water surface area to wetland area	Component
3) Proportion of overland runoff retained in system	Component
4) 5-day BOD loading	Component
C. Geographic and Other Locational Factors	Subfunction
1) Frost-free days	Component
2) Location with reference to known pollution sources	Component

Table C.0-1 (Continued).

Parameter	Hierarchical Category
VIII. CULTURAL VALUES	FUNCTION
A. Socioeconomic Benefits	Subfunction
1) Commercial fisheries	Component
2) Renewable resources and agriculture	Component
B. Culturally Perceived Values	Subfunction
1) Recreation	Component
2) Aesthetics	Component
3) Historical and archaeological importance	Component
IX. SPECIAL VALUES	FUNCTION
A. Habitat for Rare, Restricted, and Relic Flora and Fauna	Subfunction
B. Other Considerations	Subfunction

on the other hand, was found to have widespread application on a geographical basis plus was applicable in evaluating wetlands over a wide range of conditions, from inland to coastal. WEP was therefore appropriate for use in the Suwannee River basin which contains a wide range of wetlands.

In response to comments by cooperating agencies, a new procedure, published after the Environmental Impact Statement (EIS) effort was initiated, was used to evaluate the wetlands selected for the Reppert et al. (1979) evaluation. The new procedure -- Method for Wetland Functional Assessment (Adamus 1983) -- was developed for the Federal Highway Administration (FHWA). This method was not available for evaluation by Lonard et al. (1981); however, it incorporates many of the criteria evaluated by Lonard et al. (1981) as well as addresses specific deficiencies and problems identified in existing methodologies. It addresses all important, presently-recognized wetland functions and wetland types and is the only evaluation methodology that specifically uses the U.S. Fish and Wildlife Service wetland classification scheme (Cowardin et al. 1979).

The FHWA procedure addresses all five critical elements listed by Lonard et al. (1981), has widespread geographical applicability, and can be used over a broad range of wetland types. Wetland functions evaluated using the FHWA method include:

- groundwater recharge
- groundwater discharge
- flood storage and desynchronization
- shoreline anchoring and dissipation of erosion forces
- sediment trapping
- nutrient retention and removal
- food chain support
- habitat for fisheries
- habitat for wildlife
- active recreation
- passive recreation and heritage value.

The ratings are based on answers to a series of questions of varying complexity. Each function is rated as very high, high, moderate, low, and very low based on the integrated rating of three components: opportunity, effectiveness, and significance. Opportunity considers whether a wetland has the chance to fulfill a particular function; effectiveness considers the probability of a wetland being able to maximize the opportunity, if given; and significance considers the degree to which the function is valued by society.

The following sections present methods and results of both the WEP and FHWA evaluations for selected wetlands in the project area.

C.1 WEP Method

In response to comments from the U.S. Environmental Protection Agency, Florida Department of Environmental Regulation, and Florida Game and Fresh Water Fish Commission, the WEP methodology was revised by the

Jacksonville District Army Corps of Engineers (ACOE) to address concerns raised by cooperating agencies on the EIS (Table C.1-1). All references to marine and/or estuarine ecosystems were eliminated, and the freshwater criteria were reorganized. The original 3-point scale of the procedure was expanded to a 4-point scale. These changes were in addition to previous modifications which incorporated the Habitat Evaluation System (HES), developed by the Lower Mississippi Valley Division of the ACOE (1980), into the general and specialized habitat subfunction component of the wetlands evaluation system. Previous modifications also considered the ability of a wetland to supply the necessary habitat requirements of selected species, suggested by the Florida Game and Fresh Water Fish Commission.

C.2 Evaluation Criteria and Methodology

The evaluation criteria for the WEP components listed in Table C.1-1 are outlined in Sections C.2.1 - C.2.7. All components of the modified WEP system were essentially utilized in each evaluation because, when considering the Suwannee River basin, all functions listed are provided in some degree by some wetlands in the area, even though each individual wetland may not provide each of the listed functions. Detailed evaluation criteria for each species used in the general and specialized habitat evaluation are provided in Appendix D. Section C.2.8 discusses the scoring protocol used for developing the final ratings for each wetland evaluated.

C.2.1 Natural Biological Functions

C.2.1.1 Food Chain Production

Net Primary Productivity. Primary productivity is the rate at which producer organisms accomplish energy fixation from sunlight and store this energy as organic compounds or potential food resources. Net primary productivity is a measure of the available resource beyond that required to maintain the producing organism and that which is available for ingestion or uptake by consumer organisms.

Different species or vegetation associations usually have different net productivity values. In order to determine the total net productivity of a wetland unit, it was necessary to determine the mean net productivity of an area as the sum of the percent area occupied by each vegetation association multiplied by its particular net primary productivity value.

A review of the literature indicates the following ranges of net primary productivity values for various associations dependent on various disturbance factors and in particular the hydrological condition of the wetland, e.g., flowing water, still water, or sluggish water system (Mitsch and Ewel 1979, Brown 1981, and Brinson et al. 1981):

300-1400 $g/m^2/yr$ for still water systems,
300-1600 $g/m^2/yr$ for sluggish water systems, and
600-2000 $g/m^2/yr$ for flowing water systems.

Table C.1-1. Revised Function and Component Listing for the Wetlands Evaluation Procedure (Reppert et al. 1979).

Parameter	Hierarchichal Category
I. NATURAL BIOLOGICAL FUNCTIONS	
A. Food Chain Production	FUNCTION
1) Net primary productivity	Subfunction
2) Mode of detrital transport	Subfunction
3) Food chain support	Subfunction
B. General and Specialized Habitat	FUNCTION
1) Abiotic and biotic characteristics	Subfunction
2) Evaluation of usage by selected species	Subfunction
II. HYDROLOGIC SUPPORT FUNCTION	
A. Hydrologic Periodicity	FUNCTION
B. Location or Elevation within Wetland System	FUNCTION
III. STORAGE FOR STORM AND FLOOD WATERS	
A. Flood Storage	FUNCTION
B. Flood Retardation	FUNCTION
IV. NATURAL GROUNDWATER RECHARGE	FUNCTION
V. WATER PURIFICATION THROUGH NATURAL WATER FILTRATION	
A. Wetland Type	FUNCTION
1) Hydroperiod	Subfunction
2) Vegetation density	Subfunction
B. Areal and Waste-Loading Relationships	FUNCTION
1) Total wetland size	Subfunction
2) Proportion of water surface area to wetland area	Subfunction
3) Proportion of overland runoff retained in system	Subfunction
4) 5-day BOD loading	Subfunction
C. Geographic and Other Locational Factors	FUNCTION
1) Frost-free days	Subfunction
2) Location with reference to known pollution sources	Subfunction
VI. CULTURAL VALUES	
A. Socioeconomic Benefits and Renewable Resources	FUNCTION

Table C.1-1 (Continued).

Parameter	Hierarchichal Category
B. Culturally Perceived Values	FUNCTION
1) Recreation	Subfunction
2) Aesthetics	Subfunction
3) Historical and archaeological importance	Subfunction
VII. SPECIAL VALUES	
A. Habitat for Rare, Restricted, and Relic Flora and Fauna	FUNCTION
B. Other Considerations (Shoreline Protection)	FUNCTION
1) Vegetation characteristics	Subfunction
2) Width of wetland	Subfunction
3) Fetch	Subfunction
4) Cultural usage	Subfunction

Non-forested or marsh systems range from 200 to 2000 $g/m^2/yr$ for still and sluggish water systems and 400 to 2400 $g/m^2/yr$ for riverine and perennially flowing water systems. To provide an estimate of the net primary productivity of the evaluated wetlands, a median of net productivity values ($g/m^2/yr$) from the literature was used for each vegetation association and hydrological condition:

	Hydrological Condition		
Association	Still	Sluggish	Flowing
Cypress-swamp tupelo	800	1150	1350
Cypress-cypress/pine	650	650	900
Cypress-mixed hardwoods	850	1200	1800
Mixed hardwoods	1000	1200	1800
Marsh	1100	1100	1400

Criteria for numerical ratings and values were set as follows:

Net Primary Productivity ($g/m^2/yr$)	Score
>1500	4
1201-1500	3
851-1200	2
≤850	1

Mode of Detrital Transport. Transport of nutrients in detrital-based food chains is strongly dependent on the hydrologic characteristics of the particular ecosystem. Following is a summary of wetland types and their relative export efficiency scores, as modified from Reppert et al. (1979), which were used as the evaluation criteria:

Wetland Type	Score
° Riverine marsh; seasonally or perennially flooded riverine floodplain	4
° Most freshwater wetlands adjacent to or linked to intermittently flooded riverine systems; connected lacustrine systems	3
° Freshwater wetlands adjacent to or linked to ephemeral riverine systems	2
° Isolated wetlands or wetlands connected with small ditches which flow in response to recent rainfall or are connected by sheetflow only	1

Food Chain Support. Wetlands contribute to food chains both directly and indirectly. Direct consumption is primarily by herbivores with indirect consumption represented by decomposition by detritivores and

carnivore consumption of herbivores. Evaluation of the selected wetlands was based primarily on net productivity, potential litterfall and decomposition rates of litterfall material which determine rate of availability to consumer organisms, and potential faunal utilization. Evaluation criteria and scoring were as follows:

Criteria	Score
° Wetlands with rating of 4 or 3 net primary productivity (NPP), rapid rate of decomposition, and high potential for faunal utilization	4
° Wetlands with rating of 4 or 3 NPP, moderate rate of decomposition, and high potential for faunal utilization; or rating of 2 NPP, rapid rate of decomposition, and high or moderate potential for faunal utilization	3
° Wetlands with rating of 4, 3, or 2 NPP, rapid, moderate, or low rate of decomposition, and low potential for faunal utilization; or rating of 1 NPP, rapid or moderate decomposition rate, and low potential for faunal utilization	2
° Rating of 1 NPP, low rate of decomposition, and low potential for faunal utilization	1

C.2.1.2 General and Specialized Habitat

The general and specialized habitat subfunction of WEP was evaluated based on:

1) biotic and abiotic characteristics; and
2) utilization of wetlands by selected species.

Representative wetlands in each drainage area were evaluated and assigned a numerical score of 1, 2, 3, or 4, which was later factored in with the other components of the WEP analysis.

C.2.1.2.1 Abiotic and Biotic Characteristics

Quantitative and qualitative variables were selected for the field evaluation (Table C.2-1). Descriptive data on qualitative variables were collected to characterize the habitat for use in the overall evaluation and used as input for evaluation of selected species utilization. Qualitative variables were not assigned ranking criteria as were the quantitative variables.

The following quantitative variables were evaluated using specific habitat quality index curves and tables modified from ACOE (1980), Winchester (1979), and Winchester and Harris (1979).

Wetland Size. Generally, large wetlands tend to be more vegetatively diverse and consequently support more diverse wildlife populations than

Table C.2-1. Abiotic and Biotic Evaluation Factors.

QUANTITATIVE CHARACTERISTICS
Wetland size
Wetland contiguity
Wetland type
Edge-to-area ratio
Percent overstory coverage
Percent inundation
Percent ground cover
Percent understory coverage
Structural diversity (strata and zones)
Number of trees ≥16 in. dbh
Number of standing dead trees (snags)
QUALITATIVE CHARACTERISTICS
Number of mast-producing trees
Water depth - old lichen line
Degree of disturbance
Susceptibility to fire
Substrate characteristics

smaller wetlands (Golet 1973). Structural diversity, which reflects niche diversity, is also generally more pronounced in larger wetlands. Small wetlands may not satisfy the home range requirements of some wildlife species. The habitat quality index curve used for evaluation of this parameter was developed specifically for the evaluation of freshwater wetlands in Florida (Winchester 1979, Winchester and Harris 1979, Figure C.2-1).

Wetland Contiguity. Fish and wildlife species with water-borne propagules are dependent on contiguity of wetlands for dispersal. A high degree of contiguity aids in stabilizing these population types (Odum 1977, 1978). Values assigned to various degrees of contiguity are based on those developed for Florida freshwater wetlands (Table C.2-2).

Wetland Type. Wetland types or associations vary in their value to wildlife habitat depending on certain inherent soil and hydrological relationships which, in part, control vegetation types occurring within the wetland (ACOE 1980). With progression from shrub swamps to gum to cypress to cypress/gum to mixed hardwood swamps, there is an increase in number of mast trees, denning and nesting sites, and structural complexity. This is reflected in the habitat quality index curve developed for wetland type (Figure C.2-2).

Edge-to-Area Ratio. This parameter was evaluated in terms of edge drama or structural differences along the edge of adjoining plant communities and estimated gross productivity of the two adjoining communities (Winchester and Harris 1979). The basic calculation is:

$$CEI = \frac{Ew}{2af}$$

where CEI is the "comprehensive edge index," a is the area of the wetland, and f = 3.14. Ew is the total weighted length or sum of the individual edge segments (Ei):

$$Ei = EL\ (EDV + \frac{PV_1 + PV_2}{2})$$

where EL is edge length in feet, EDV is the edge drama value, and PV_1 and PV_2 are productivity values for two adjacent vegetation associations (Table C.2-3). The CEI for a given wetland is ranked on a scale of 0.1 to 1.0.

Percent Overstory Coverage. The relative abundance of wooded versus open areas is a function of habitat diversity (Larson 1973, ACOE 1980). Generally, the more wooded area the greater the habitat value, except when overstory cover reaches ≥80-90% (Figure C.2-3, ACOE 1980). A mixture of wooded and open areas is considered to be of the greatest value to wildlife (Larson 1973, 1976).

Percent Inundation. Frequency and duration of inundation (flooding) affect the value of a wetland to wildlife because flooding influences maintenance of vegetation types, aids in dispersal of organisms and materials to downstream areas (Hall 1972, Gasaway 1973), and fulfills

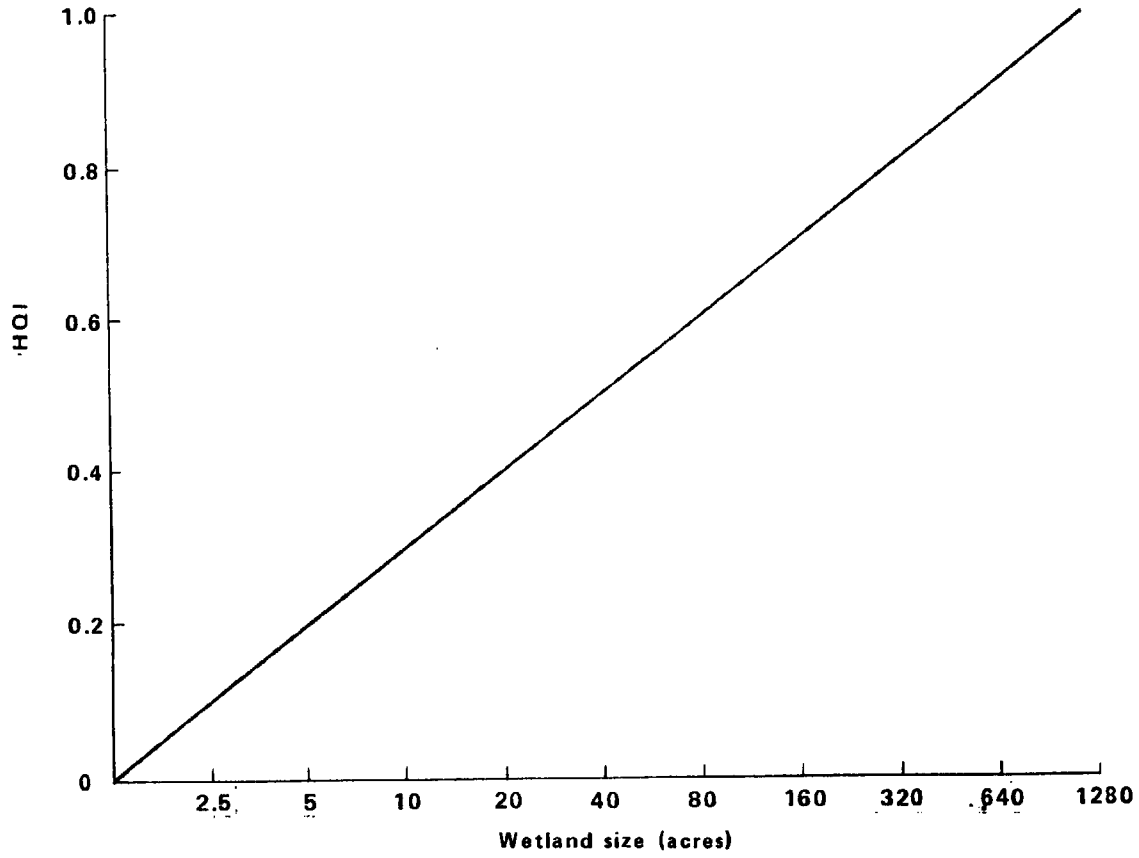


Figure C.2-1. Habitat Quality Index (HQI) Curve for Wetland Size.
(Source: Winchester 1979, Winchester and Harris 1979).

Table C.2-2. Wetland Contiguity Variables.

Degree of Connection	Score
Perched, isolated wetlands; no natural or artificial connection	0.1
Wetlands with a ditched connection or a very minor natural connection to an intermittent tributary	0.2
Wetlands with a ditched or channelized connection, where a natural channel formerly existed, to an intermittent tributary	0.3
Wetlands with a distinct, natural connection to an intermittent tributary or adjoining an intermittent tributary with less than 5 cfs average annual flow, or a ditched or very minor natural connection to a tributary	0.4
Wetlands with a ditched, channelized connection, where a natural connection formerly existed, to a perennial tributary	0.5
Wetlands adjoining an intermittent tributary with more than 5 cfs average annual flow, or wetlands with a distinct, natural connection to a perennial tributary with less than 5 cfs average annual flow	0.6
Wetlands adjoining a perennial tributary with more than 5 cfs but less than 100 cfs average annual flow	0.8
Wetlands contiguous with a perennial river having an average annual flow of 100 cfs or greater	1.0

Source: Winchester 1979, Winchester and Harris 1979.

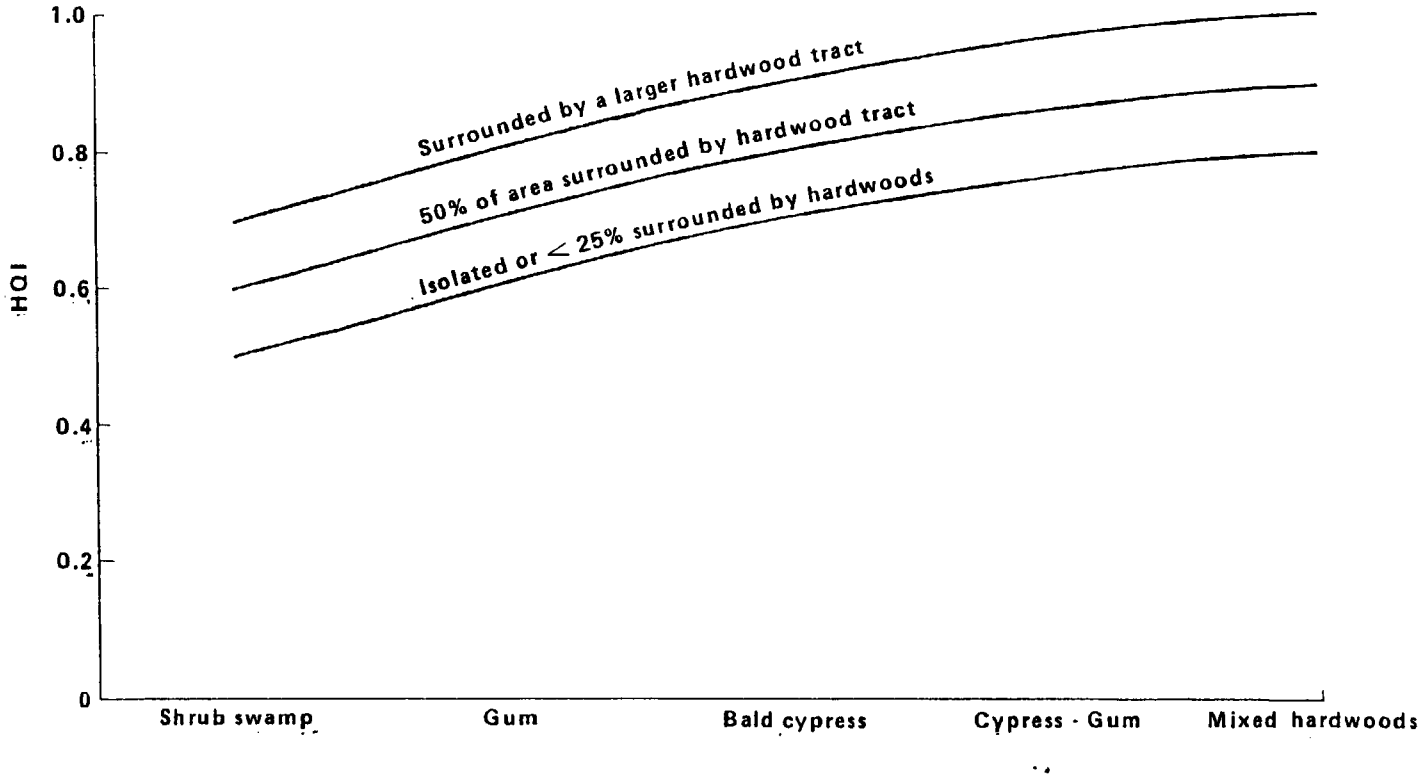


Figure C.2-2. Habitat Quality Index (HQI) Curve for Wetland Type.
(Source: ACOE 1980)

Table C.2-3. Gross Primary Productivity (GPP in $gC/m^2/day$) and Edge Drama Values for Typical Plant Communities.

Plant Community	GPP Class[1]	Edge Drama Value							
		Pasture	Fresh Marsh	Shrub Swamp	Palmetto Range	Pine Flatwoods	Xeric Hammock	Mesic Hammock	Hardwood Swamp
Pasture[2]	2	0	1	2	2	3	3	4	5
Fresh marsh[3]	5		0	2	2	3	4	4	5
Shrub swamp[4]	5			0	1	2	3	4	5
Palmetto range[2]	2				0	2	3	4	5
Pine flatwoods[2]	3					0	2	3	3
Xeric hammock[5]	2						0	2	3
Mesic hammock[6]	3							0	2
Hardwood swamp[3]	5								0

[1]Class 1: GPP≤5.0.
Class 2: 5.0<GPP≤10.0.
Class 3: 10.0<GPP≤15.0.
Class 4: 15.0<GPP≤20.0.
Class 5: GPP>20.0.

[2]Brown et al. 1975.

[3]Brown 1978.

[4]Assumed to be in the same class as fresh marshes and hardwood swamps.

[5]Assumed to be between estimated GPP for sandhills (Brown et al. 1975) and mesic hardwood forests (Lugo et al. 1978).

[6]Lugo et al. 1978.

Source: Winchester and Harris 1979.

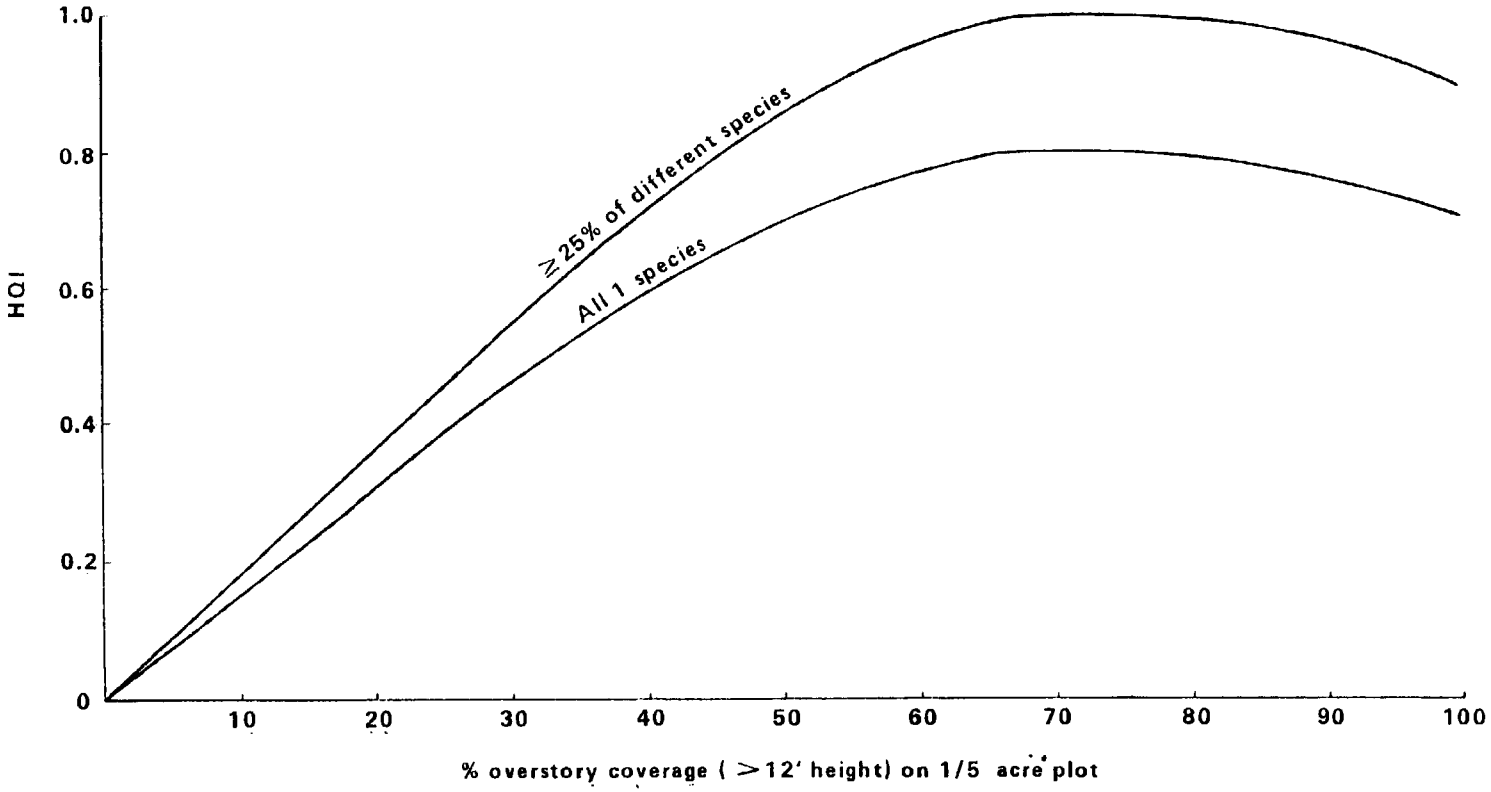


Figure C.2-3. Habitat Quality Index Curve for Percent Overstory Coverage, Swamps.
(Source: ACOE 1980)

the ecological requirements for many wildlife species for part of their life cycle (Hirsch and Segelquist 1978). Generally, an increase in percent inundation results in an increase in the value of a wetland to wildlife (Figure C.2-4, ACOE 1980). However, if inundation is ≥75%, more open water type habitat is maintained, and certain wetland vegetation species, which require a "dry" period for germination or which cannot tolerate prolonged inundation, are eliminated.

Percent Ground Cover and/or Understory Coverage. Ground cover and understory influence structural diversity of the habitat type and therefore influence faunal diversity (ACOE 1980). With an increase in ground and understory cover there is an increase in wildlife value, except when percent cover exceeds approximately 80% at which point the area may be too dense for many wildlife species (Figure C.2-5, ACOE 1980).

Structural Diversity. Wildlife abundance and diversity are directly related to vegetation diversity and complexity (MacArthur et al. 1962, Anderson et al. 1978, Weller 1978). An increase in structural diversity, i.e., the number of zones (horizontal layers) and number of strata (vertical layers), generally results in increased value of a wetland to wildlife (Table C.2-4).

Number of Trees ≥16 in. dbh. Large trees provide denning sites for wildlife and contribute to the aesthetic appeal of the wetland (Leopold 1932, Byrd and Halbrook 1974, USFS 1975). Tree size is also an indication of maturity and subsequent fruiting, which is of particular importance to wildlife that rely on mast for food resources (ACOE 1980). A habitat quality index curve developed by the ACOE (1980) was used for this parameter (Figure C.2-6).

Number of Standing Dead Trees (Snags). Standing dead trees are used for nest sites by cavity nesting species and as a food source by insectivorous species (Leopold 1932, Glasgow and Noble 1971, USFS 1975). An increase in numbers of standing dead trees may increase the wildlife value of the habitat; however, too many standing dead trees may be an indication of stress which would result in lower value to wildlife (Figure C.2-7).

Field Applications

Sites used for evaluations were along baseline transects in the wetland areas (Section 4.2). Standard field forms were used for itemizing the quantitative and qualitative data variables (Table C.2-5). At each point along the transect (at varying intervals, depending on transect length), quantitative variables were evaluated and descriptive data taken for the five qualitative variables.

Data Analysis

Data collected from transects for the quantitative variables were evaluated against the habitat quality index curves (Figures C.2-1 through C.2-7), and a numerical value from 0.1 to 1.0 was assigned. Values for each of the eleven quantitative variables for each wetland were then averaged and summed. A scale was formulated relating the possible scores (1.0 to 11.0) to the numerical rating of the WEP analysis (1, 2,

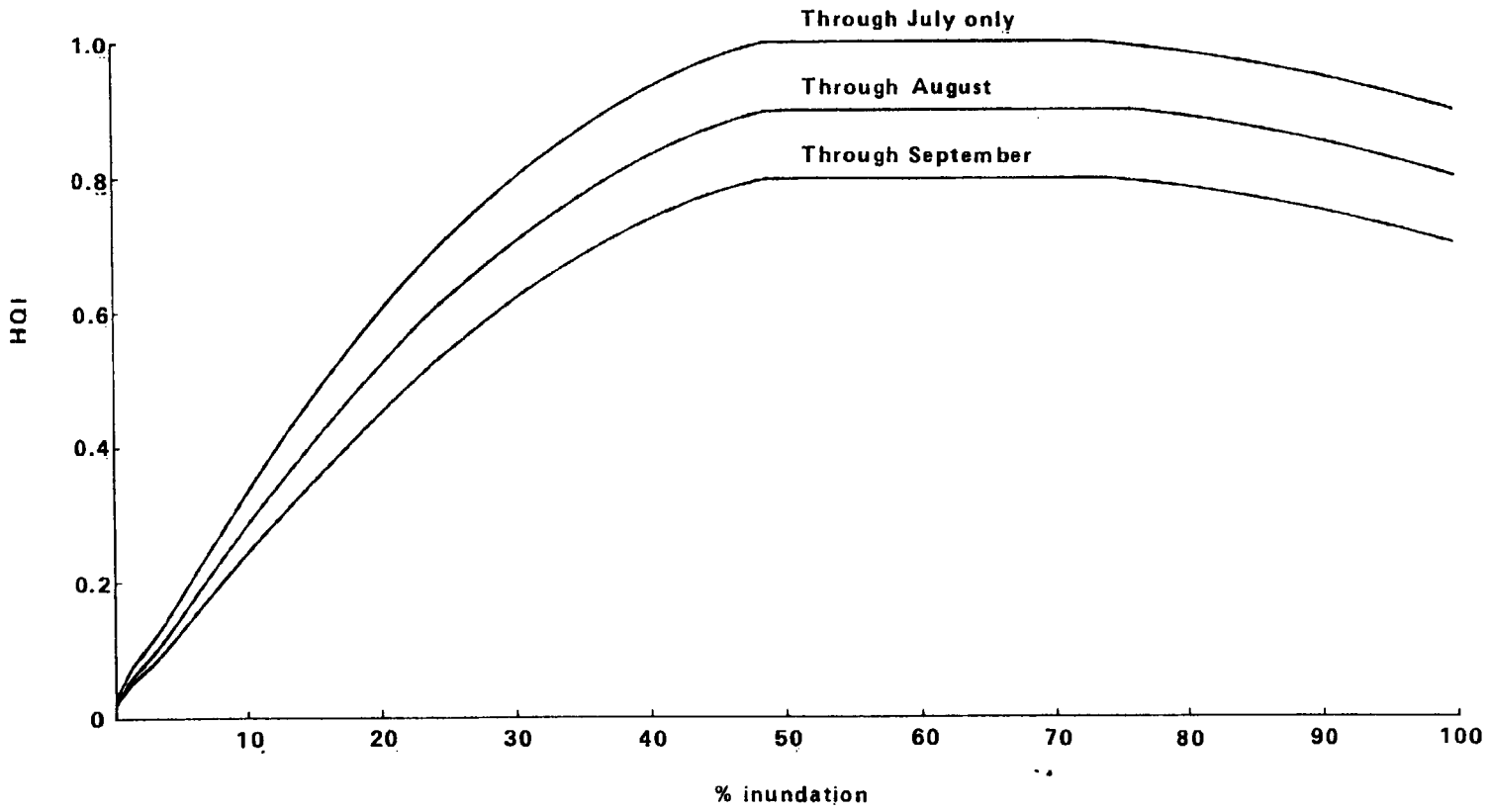


Figure C.2-4. Habitat Quality Index (HQI) Curve for Percent Inundation, Swamps.
(Source: ACOE 1980)

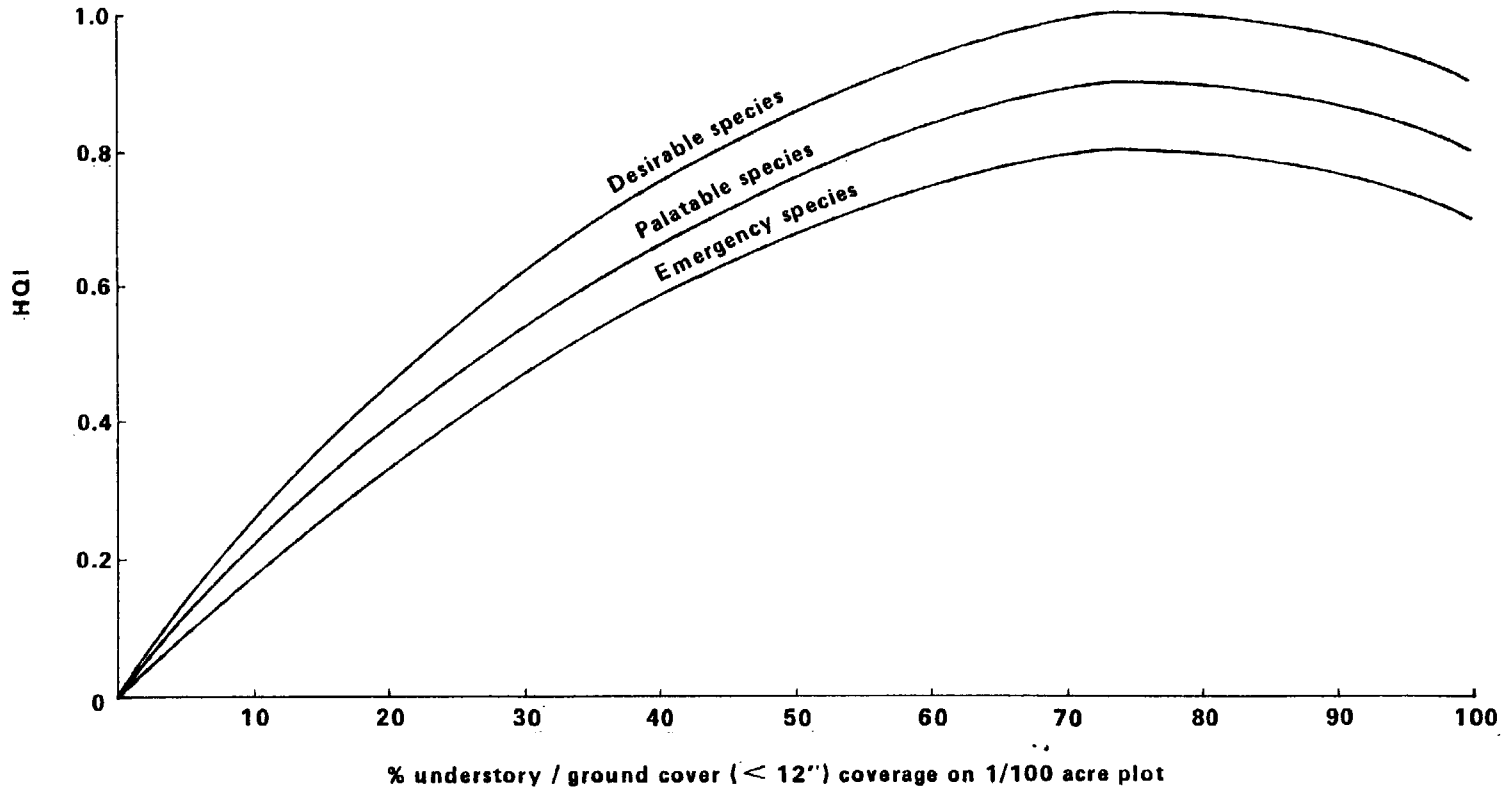


Figure C.2-5. Habitat Quality Index (HQI) Curve for Percent Ground Cover and/or Understory Coverage, Swamps. (Source: ACOE 1980)

Table C.2-4. Functional Evaluation Criteria for Structural Diversity.

No. of Strata	No. of Vegetation Zones	Score
1	1	0.1
1	2	0.2
1	3	0.3
2	1	0.4
2	2	0.5
2	3	0.6
3	1	0.7
3	2	0.8
3	3	0.9
3	4	1.0

Adapted from Winchester 1979, Winchester and Harris 1979.

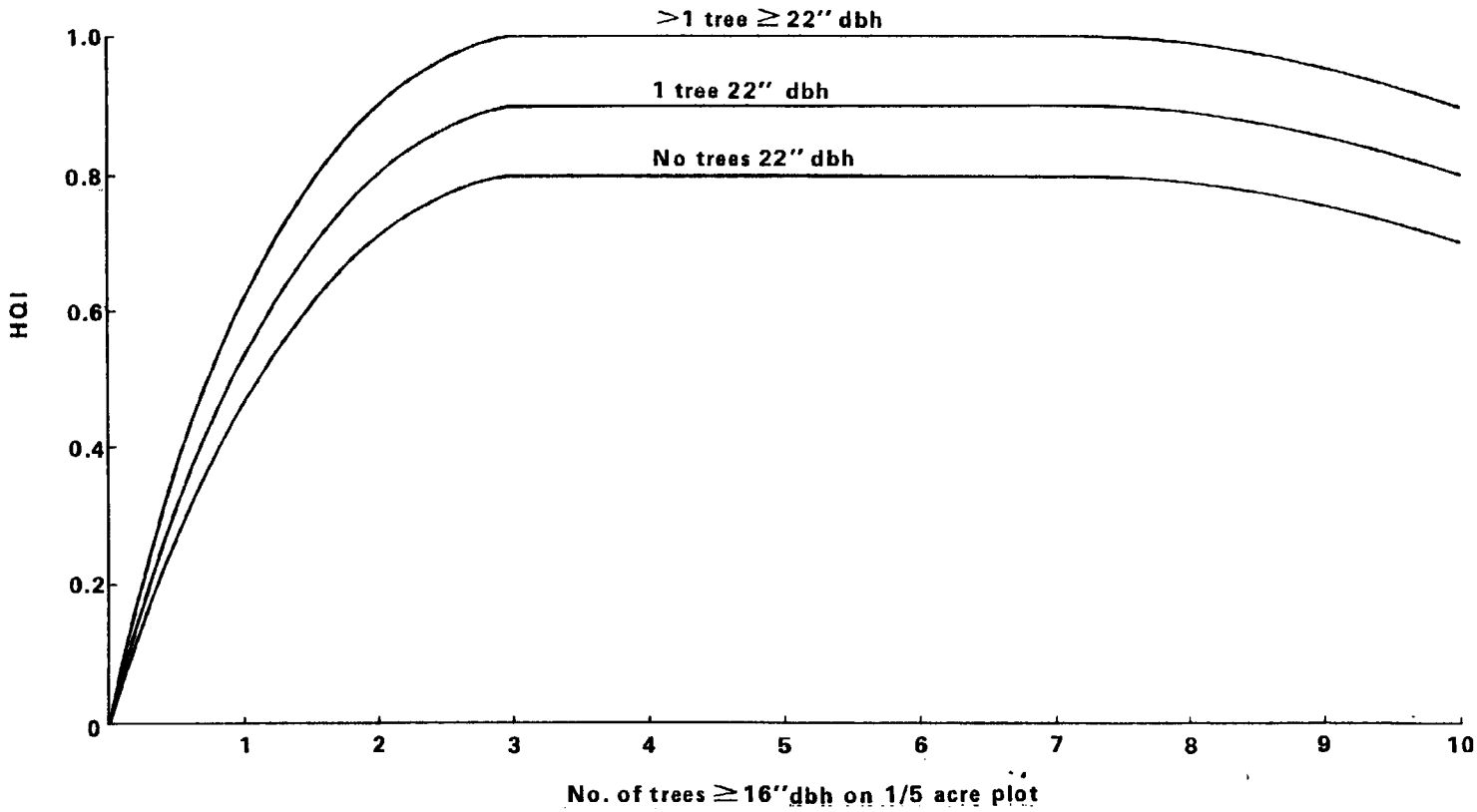


Figure C.2-6. Habitat Quality Index (HQI) Curve for Large Trees, Swamps.
(Source: ACOE 1980)

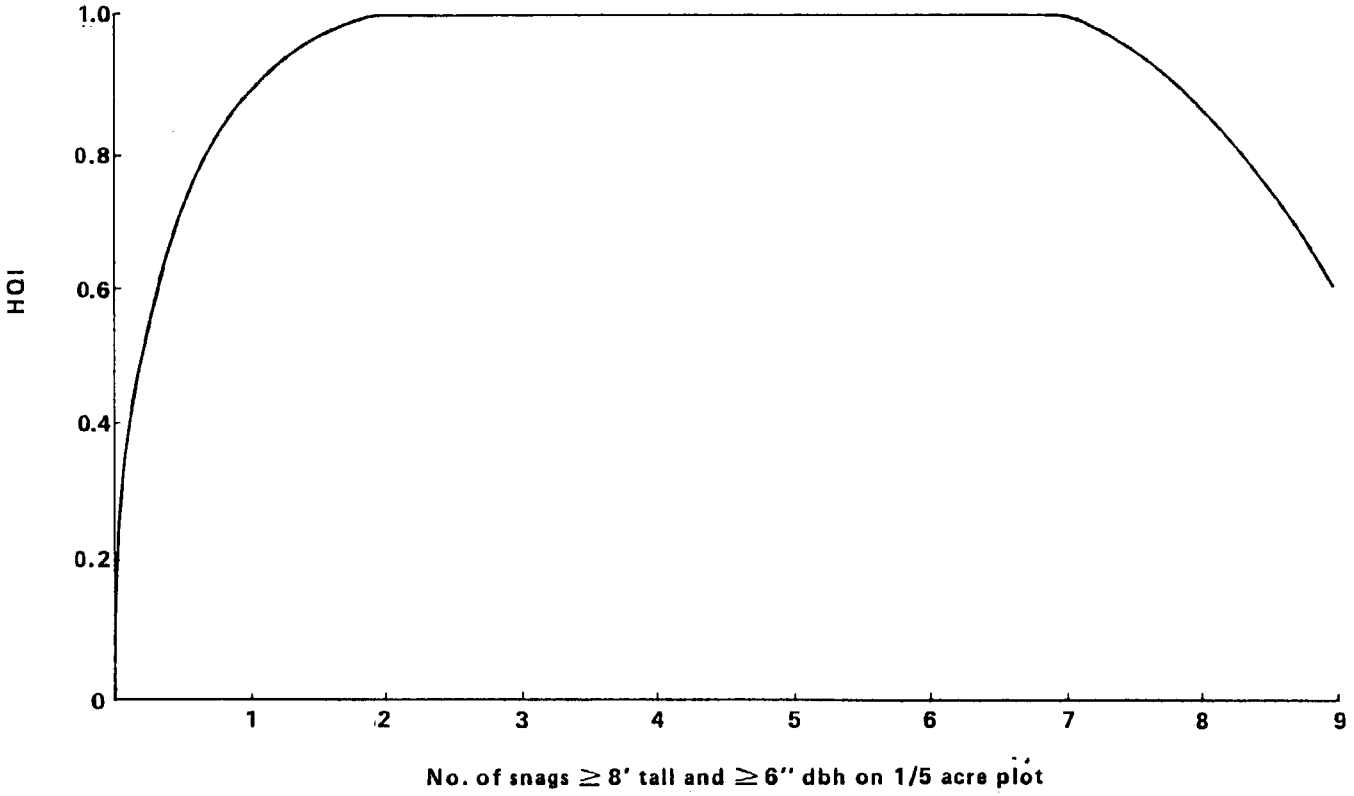


Figure C.2-7. Habitat Quality Index (HQI) Curve for Number of Snags, Swamps.
(Source: ACOE 1980)

Table C.2-5. WEP Data Form for Habitat Evaluation.

Location: _____
Drainage: _____
Personnel: _____
Size: _____

Project: _____
Date: _____
Time: _____
HQI: _____

	1		2		3		4		5		6		7		8		9		10		11		12	
Key Variable	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV	Data	HV
1. Species association																								
2. Coverage																								
3. % ground cover																								
4. % understory																								
5. Mast trees																								
6. Trees ≥16 in dbh																								
7. Tract size																								
8. Snags -- dead and standing																								
9. % inundation																								
10. No. of strata																								
11. No. of zones																								
12. Edge/area ratio																								
13. % open water																								
14. Wetland contiguity																								

Comments:

3, or 4). These ratings were averaged in with scores for the species utilization evaluations (Section C.2.1.2.2) to yield a final numerical rating of 1 (low), 2 (medium), 3 (high), or 4 (very high) for each wetland in terms of the general and specialized habitat subfunction as follows:

Abiotic and Biotic Score	Wetland Score
9-11	4
6-8	3
3-5	2
1-2	1

C.2.1.2.2 Utilization by Selected Species

Reppert et al. (1979) suggest that evaluation of wildlife utilization of a wetlands be conducted at a local level using a checklist of key species (Table C.2-6). The Florida Game and Fresh Water Fish Commission (FGFWFC) provided a checklist of key wildlife species for habitat evaluation based on the following habitat types (Tables C.2-7, C.2-8, C.2-9, and C.2-10; Randy S. Kautz, FGFWFC, letter dated 12 February 1982 to John A. Davis):

- cypress strands and domes
- bayheads
- mixed swamps
- hydric hammocks (bottomlands along streams).

In areas of standing water, fish species were included in the evaluation (Table C.2-11). These lists were modified to include species characteristic of the habitat types and to eliminate those species not occurring in the geographical area. For each species, ecological requirements criteria for reproduction, food, and habitat were developed from available literature sources. Each of the three criteria was used to evaluate the ability of the wetland to support each species, and an overall rating of 1, 2, or 3 was applied to the habitat significance for that species.

Field Applications

Species checklists were used for evaluation of the entire wetland (Tables C.2-12 and C.2-13). The ability of the wetland to meet food, habitat, and reproductive requirements of the species was evaluated based on quantitative and qualitative data collected and a general walk-through of the wetland. For each species a value of 1, 2, or 3 was assigned for the habitat and its support functions. Evaluation criteria for each species on the checklists are included in Appendix D.

Data Analysis

The species checklist scores (rated from 0 to 3) were averaged for each wetland and then averaged in with the ratings from the biotic/abiotic characteristics evaluations (Section C.2.1.2.1) to yield a final

Table C.2-6. Habitat Evaluation Checklist (Key Game, Commercial, and Aesthetic Species).

Fish and Wildlife Species	Habitat Significance			Remarks
	High (3)	Mod. (2)	Low (1)	
Overall Habitat Value				

Source: ACOE 1980.

Table C.2-7. Wildlife Species of Cypress Strands and Domes in the Project Area.

Eastern lesser siren (*Siren i. intermedia*)
Flatwoods salamander (*Ambystoma cingulatum*)
Pine woods treefrog (*Hyla femoralis*)
Bullfrog (*Rana catesbeiana*)
Pig frog (*Rana grylio*)
Florida mud turtle (*Kinosternon subrubrum*)
Eastern glossy water snake (*Nerodia r. rigida*)
Black swamp snake (*Seminatrix pygaea*)
Eastern indigo snake (*Drymarchon corais couperi*)
Florida cottonmouth (*Agkistrodon piscivorus conanti*)
Wading birds (Ciconiiformes)
Wood duck (*Aix sponsa*)
Red-shouldered hawk (*Buteo lineatus*)
Turkey (*Meleagris gallopavo*)
Barred owl (*Strix varia*)
Red-bellied woodpecker (*Melanerpes carolinus*)
Tufted titmouse (*Parus bicolor*)
Carolina wren (*Thryothorus ludovicianus*)
White-eyed vireo (*Vireo griseus*)
Warblers (Parulidae)
Eastern gray squirrel (*Sciurus carolinensis*)
Cotton mouse (*Peromyscus gossypinus*)
Eastern woodrat (*Neotoma floridana*)
Rice rat (*Oryzomys palustris*)
White-tailed deer (*Odocoileus virginianus*)

Source: FGFWFC.

Table C.2-8. Wildlife Species of Bayheads in the Project Area.

Eastern lesser siren (Siren i. intermedia)
Southern dusky salamander (Desmognathus auriculatus)
River frog (Rana heckscheri)
Bronze frog (Rana c. clamitans)
Florida water snake (Nerodia fasciata pictiventris)
Striped swamp snake (Regina alleni)
Pine woods snake (Rhadinea flavilata)
Eastern mud snake (Farancia a. abacura)
Eastern indigo snake (Drymarchon corais couperi)
Black vulture (Coragyps atratus)
Barred owl (Strix varia)
Pileated woodpecker (Dryocopus pileatus)
Yellow-bellied sapsucker (Sphyrapicus varius)
Hermit thrush (Catharus guttata)
Blue-gray gnatcatcher (Polioptila caerulea)
Solitary vireo (Vireo solitarius)
Warblers (Parulidae)
Common grackle (Quiscalus quiscula)
White-throated sparrow (Zonotrichia albicollis)
Southeastern shrew (Sorex longirostris)
Golden mouse (Ochrotomys nuttalli)
Eastern woodrat (Neotoma floridana)
Rice rat (Oryzomys palustris)
Florida black bear (Ursus americanus floridanus)

Source: FGFWFC.

Table C.2-9. Wildlife Species of Mixed Swamps in the Project Area.

Two-toed amphiuma (Amphiuma means)
Greater siren (Siren lacertina)
River frog (Rana heckscheri)
Bronze frog (Rana c. clamitans)
Alligator (Alligator mississippiensis)
Striped mud turtle (Kinosternon bauri palmarum)
Brown water snake (Nerodia taxispilota)
Eastern mud snake (Farancia a. abacura)
Florida cottonmouth (Agkistrodon piscivorus conanti)
Wading birds (Ciconiiformes)
Wood duck (Aix sponsa)
Swallow-tailed kite (Elanoides forficatus)
Red-shouldered hawk (Buteo lineatus)
Yellow-billed cuckoo (Coccyzus americanus)
Barred owl (Strix varia)
Woodpeckers (Piciformes)
Acadian flycatcher (Empidonax virescens)
White-eyed vireo (Vireo olivaceus)
Warblers (Parulidae)
Bats (Chiroptera)
Eastern gray squirrel (Sciurus carolinensis)
River otter (Lutra canadensis)
Florida black bear (Ursus americanus floridanus)
Wild hog (Sus scrofa)

Source: FGFWFC.

Table C.2-10. Wildlife Species of Hydric Hammocks in the Project Area.

Mole salamander (Ambystoma talpoideum)
Southern dusky salamander (Desmognathus auriculatus)
Slimy salamander (Plethodon g. glutinosus)
Eastern spadefoot toad (Scaphiopus h. holbrooki)
Striped mud turtle (Kinosternon bauri palmarum)
Broad-headed skink (Eumeces laticeps)
Florida brown snake (Storeria dekayi victa)
Florida red-bellied snake (Storeria occipitomaculata obscura)
Eastern kingsnake (Lampropeltis g. getulus)
Red-shouldered hawk (Buteo lineatus)
Northern bobwhite (Colinus virginianus)
Mourning dove (Zenaida macroura)
Barred owl (Strix varia)
Pileated woodpecker (Dryocopus pileatus)
Acadian flycatcher (Empidonax virescens)
Brown thrasher (Toxostoma rufum)
White-eyed vireo (Vireo olivaceus)
Rufous-sided towhee (Pipilo erythrophthalmus)
Swamp sparrow (Melospiza georgiana)
Southeastern shrew (Sorex longirostris)
Seminole bat (Lasiurus seminolus)
Eastern gray squirrel (Sciurus carolinensis)
Southern flying squirrel (Glaucomys volans)
Weasel (Mustela frenata)

Source: FGFWFC.

Table C.2-11. Fish Species for Evaluation.

Redfin pickerel (*Esox americanus*)
Eastern mud minnow (*Umbra pygmaea*)
Pirate perch (*Aphredoderus sayanus*)
Mud sunfish (*Acantharchus pomotis*)
Swamp darter (*Etheostoma fusiforme*)
Golden topminnow (*Fundulus chrysotus*)
Least killifish (*Heterandria formosa*)
Flagfish (*Jordanella floridae*)
Banded pygmy sunfish (*Elassoma zonatum*)
Warmouth (*Lepomis gulosus*)

Source: FGFWFC.

Table C.2-12. Species Checklist for Cypress Domes and Strands.

Location	_____	Project	_____
Drainage	_____	Date	_____
Size	_____	Time	_____
Personnel	_____		

Species	Rating	Remarks
FISH		
Redfin pickerel		
Eastern mud minnow		
Pirate perch		
Mud sunfish		
Swamp darter		
Golden topminnow		
Least killifish		
Flagfish		
Banded pygmy sunfish		
Warmouth		
AMPHIBIANS		
Eastern lesser siren		
Flatwoods salamander		
Pine woods treefrog		
Bullfrog		
Pig frog		
REPTILES		
Florida mud turtle		
Eastern glossy water snake		
Black swamp snake		
Eastern indigo snake		
Florida cottonmouth		
BIRDS		
Wading birds (Ciconiiformes)		
Wood duck		
Red-shouldered hawk		
Turkey		
Barred owl		
Red-bellied woodpecker		
Tufted titmouse		
Carolina wren		
White-eyed vireo		
Warblers (Parulidae)		
MAMMALS		
Eastern gray squirrel		
Cotton mouse		
Eastern woodrat		
Rice rat		
White-tailed deer		

Table C.2-13. Species Checklist for Mixed Swamps.

Location		Project	
Drainage		Date	
Size		Time	
Personnel			

Species	Rating	Remarks
FISH		
Redfin pickerel		
Eastern mud minnow		
Pirate perch		
Mud sunfish		
Swamp darter		
Golden topminnow		
Least killifish		
Flagfish		
Banded pygmy sunfish		
Warmouth		
AMPHIBIANS		
Two-toed amphiuma		
Greater siren		
River frog		
Bronze frog		
REPTILES		
Alligator		
Striped mud turtle		
Brown water snake		
Eastern mud snake		
Florida cottonmouth		
BIRDS		
Wading birds		
Wood duck		
Swallow-tailed kite		
Red-shouldered hawk		
Yellow-billed cuckoo		
Barred owl		
Woodpeckers		
Acadian flycather		
White-eyed vireo		
Warblers		
MAMMALS		
Bats		
Eastern gray squirrel		
River otter		
Florida black bear		
Wild hog		

numerical rating of 1, 2, 3, or 4 for each wetland in terms of the general and specialized habitat subfunction as follows:

Species Utilization Score	WEP Score
>75	4
51-75	3
26-50	2
≤25	1

C.2.2 Hydrologic Support Function

The hydrologic support function is defined "as the role which a specific wetland area plays in maintaining the stability and environmental integrity of the entire system to which it is physically and functionally related" (Reppert et al. 1979). Although it is difficult to quantify the hydrologic support function for a particular wetland area, the relative importance of the function can be estimated through a basic analysis of the hydrologic periodicity and location or elevation of the wetland area.

C.2.2.1 Hydrologic Periodicity

The following framework for evaluating hydrologic periodicity as it relates to the hydrologic support function was modified from Reppert et al. (1979):

Type of Wetland System	Score
Normally flooded riverine wetlands	4
Normally or seasonally flooded wetlands connected to perennial streams or open waterbodies	3
Intermittently flooded wetlands connected to perennial or intermittent streams or waterbodies	2
Isolated wetlands or wetlands connected to small ditches which flow in response to recent rainfall or are connected by sheetflow only	1

This component was evaluated by analysis of aerial photography (c. 1979) and ground-truthing of the selected wetlands.

C.2.2.2 Location or Elevation within Wetland System

The following framework for evaluating the effect of the location and/or elevation of the wetland on the hydrologic support function was modified from Reppert et al. (1979):

Locational Factor	Score
In lake or river systems, from low water level to mean water level	4
In lake or river systems, from mean water level to upper limit of marsh	3
Normally flooded, intermittenty connected wetland systems	2
Hydrologically isolated systems	1

This component was evaluated by analysis of aerial photography (c. 1979) and ground-truthing of the selected wetlands.

C.2.3 Storage for Storm and Flood Waters

Wetland areas often are important for water storage and flow retardation during flood periods. The storage provided by these areas can reduce the volume and energy of flood flows. Vegetative cover in the wetland also can lessen the energy of the flood wave. However, alternate landscapes such as upland sites of gentle relief appear to have a better overall water absorption and detention capability than some wetlands, as wetlands are, by definition, already saturated. Evaluation of flood water storage and flow retardation was approximated using topographic and geologic maps, hydrologic data, field observations, and other available information (Section 3.4.1.1). Each wetland was ranked on the rating system established by Reppert et al. (1979) but modified to a 4-point scale:

1) Flood Storage

Area of Wetlands (% of watershed)	Potential Flood Damage Reduction Score
>20%	4
11-20%	3
6-10%	2
≤5%	1

2) Flood Retardation

% Vegetation Cover of Wetland (Wooded or Shrub Swamps)	Potential Flood Damage Reduction Score
>30%	4
21-30%	3
11-20%	2
≤10%	1

C.2.4 Natural Groundwater Recharge

Wetlands may serve as important groundwater recharge or discharge areas, depending on the elevation of the water table. The groundwater function of a wetland is a complicated process related to overland flow, interception, infiltration, depression storage, interflow, groundwater flow, and morphological features such as soil type and substrate geometry.

The natural groundwater recharge potential of the wetlands on site was evaluated based on hydrologic data incorporated into the following matrix (Reppert et al. 1979):

Groundwater Recharge Area (areal extent of wetlands to be mined as % of total watershed)	Score for Hydrologic Characteristics of Wetland Substrate and Aquifer (porosity, permeability, and transmissivity)		
	High	Moderate	Low
>5%	4	3	2
4-5%	3	2	1
2-3%	2	1	1
<2%	1	1	1

C.2.5 Water Purification Through Natural Water Filtration

A variety of physical, biological, and chemical processes can occur in wetland systems to naturally purify water by removal of organic and mineral matter from rivers and streams. Wetlands are sometimes considered analogous to wastewater treatment plants in their waste removal and water purification abilities. However, there is an important difference in that the primary goal of wastewater treatment plants is removal of waste material, whereas the result of the wetland water treatment is an actual recycling of pollutants. Within wetlands it is also important to distinguish between the potential for water quality purification and actual water quality purification through natural filtration and assimilation. For example, wetlands that are hydrologically isolated and receive little to no surface water runoff from surrounding areas may have the potential for water purification abilities but do not actually provide this function to any significant degree. On the other hand, wetlands with strong hydrological connections and the potential for water purification may not be efficient in water purification due to such factors as volume and velocity of water flowing into and out of the wetland. In some cases, wetlands may actually discharge relatively higher concentrations of certain parameters than the concentrations of these parameters coming into the system.

Evaluation of the water quality purification or enhancement component incorporated three types of criteria to encompass environmental considerations relevant to a wetland's ability to provide water quality improvement. These included wetland type, areal and waste-loading relationships, and geographic and other locational factors (Table C.2-14).

Table C.2-14. Factors Affecting the Water Quality Function of Wetlands and Criteria for Evaluation.

Evaluation Factors	Criteria	Score
1) Wetland Type		
a) Hydroperiod	Perennial riverine wetlands	4
	Seasonally flooded lacustrine	3
	Seasonally flooded riverine	3
	Intermittently flooded riverine	2
	Intermittently flooded lacustrine or normally connected palustrine	2
	Isolated or weakly connected palustrine	1
b) Vegetation density	Coverage >80%	4
	Coverage 51-80%	3
	Coverage 20-50%	2
	Coverage <20%	1
2) Areal and Waste-Loading Relationships		
a) Total wetland size	>200 acres	4
	76-200 acres	3
	10-75 acres	2
	<10 acres	1
b) Proportion of water surface area to wetland area (acres, hectares)	<40%	4
	40-60%	3
	61-75%	2
	>75%	1
c) Proportion of water volume flowing through wetland or overland runoff retained in the system (cfs, mgd)	>50%	4
	26-50%	3
	10-25%	2
	<10%	1
d) 5-day BOD loading (lb BOD/acre/day)	<5 lb	4
	5-15 lb	3
	16-25 lb	2
	>25 lb	1
3) Geographic and Other Locational Factors		
a) Frost-free days	>250 days	4
	176-250 days	3
	90-175 days	2
	<90 days	1
b) Location with reference to known pollution sources	Below source of municipal discharge or above water intakes	4
	Below non-point source pollution	3
	Below industrial discharges	2
	Water quality in wetland already degraded	1

C.2.6 Cultural Values

C.2.6.1 Socioeconomic Benefits and Renewable Resources

Utilization of the wetlands on site for timber production, grazing, and other agricultural uses was evaluated based on available literature from state forestry personnel, county extension agents, and the Soil Conservation Service. Additionally, use or potential for use of the evaluated wetlands was appraised during the field survey. Evaluation criteria and scoring for each wetland were as follows:

Criteria	Score
° Wetlands heavily used for silviculture or agriculture	4
° Wetlands having immediate potential for economic, silvicultural, or agricultural usages	3
° Future potential for economic, silvicultural, or agricultural usage	2
° Little or no economic usage due to presence of selected species, access problems, or size	1

C.2.6.2 Culturally Perceived Values

Culturally perceived components evaluated included recreation, aesthetics, and historical and archaeological importance.

Recreation. Recreational value of the wetland was based on use of the wetland for activities such as hunting, fishing, bird-watching, and nature study. Following are evaluation criteria and their respective scores for recreational values of the wetlands on the project site:

Criteria	Score
° Wetlands heavily used for 3 or more recreational activities (e.g., hunting, fishing, bird-watching, nature study)	4
° Wetlands heavily used for at least 2 types of recreational activities or moderately used for 3 or more types	3
° Wetlands having the immediate potential for heavy usage of at least 1 recreational type or moderate usage for 2 or more	2
° Wetlands with little or no value for recreational activities based on their size, level of disturbance, or accessibility	1

Aesthetics. The approach recommended by Reppert et al. (1979) was used to assess an aesthetic value for the area. Non-conforming uses and other negative criteria were considered. Evaluation was based on the "degree to which the negative elements or influences affect the overall perception of the wetland." Following is the framework for evaluation and scoring of the wetlands aesthetic values:

Criteria	Score
° Wetlands visible from road, accessible by foot, with limited disturbance by man, and with compatible adjacent land use (e.g., naturally forested areas)	4
° Wetlands meet three of four criteria of visibility, accessibility, limited disturbance by man, or compatible adjacent land use	3
° Wetlands meet two of four criteria of visibility, accessibility, limited disturbance by man, or compatible adjacent land use	2
° Wetlands meet one or none of four criteria of visibility, accessibility, limited disturbance by man, or compatible adjacent land use.	1

Historical and Archaeological Importance. Wetlands were evaluated based on results of the historical and archaeological survey conducted on the project site (Section 3.8). The following criteria were utilized in assigning wetland values:

Criteria	Score
° Wetlands with historical and/or archaeological sites which have been listed on the National Register of Historic Places	4
° Wetlands with historical or archaeological sites which are eligible for listing on the National Register of Historic Places	3
° Wetlands with identified historical or archaeological sites which are of interest but not of importance necessary to be eligible for listing on the National Register of Historic Places	2
° Wetlands with no identified historical or archaeological sites.	1

C.2.7. Special Values

C.2.7.1 Habitat for Rare, Restricted, and Relic Flora and Fauna

Wetlands were evaluated for their potential to provide habitat for rare and endangered species based on actual observation of individual species and evaluation of habitat characteristics. Criteria for evaluation and scoring were:

Criteria	Score
° Known breeding, nesting, or feeding area of an endangered species protected by the U.S. Fish and Wildlife Service (FWS) and/or Florida Game and Fresh Water Fish Commission (FGFWFC)	4
° Known breeding, nesting, or feeding area of a threatened species protected by the FWS and/or FGFWFC	3
° Wetlands considered to have suitable characteristics for use as a breeding, nesting, or feeding area by endangered or threatened species protected by the FWS or FGFWFC	2
° Wetlands not considered suitable for providing a breeding, nesting, or feeding area for endangered or threatened species protected by the FWS and/or FGFWFC	1

C.2.7.2 Other Considerations (Shoreline Protection)

This subfunction is not performed to any significant degree by wetlands on the project site. However, reclaimed areas (lakes with wetland fringes) do provide this function. Evaluation criteria follow Reppert et al. (1979) with the exceptions that the scoring has been expanded to a 4-point scale and criteria were developed for cultural usage:

Vegetation Characteristics	Score
Type of wetland vegetation	
° Shrub and arboreal species	4
° Non-woody emergents	3
° Floating-leaved species and rooted submergents which come to or near the surface	2
° Rooted submergents which extend less than halfway to the surface or no vegetation	1
Density of total vegetation community	
° Dense coverage >80%	4
° Semi-dense coverage 51-80%	3
° Moderate coverage 20-50%	2
° Open <20%	1

Width of Wetland	Score
° >100 yd	4
° 51-100 yd	3
° 26-50 yd	2
° ≤25 yd	1

Fetch	Score
° >2 mi	4
° 1-2 mi	3
° 0.5-1 mi	2
° <0.5 mi	1

Cultural Usage	Score
° Heavy usage by wake-generating power boating	4
° Anticipated heavy usage by wake-generating power boating or existing moderate usage	3
° Light to moderate usage by wake-generating power boating	2
° Power boating with restriction of 10 or less horsepower motors and/or a no wake zone, no power boating, or small size boats with no power boating	1

C.2.8 Wetlands Evaluation Scoring

Average scores were obtained for each function category of the revised WEP (Table C.1-1). Each function category may be made up of subfunction categories. In the analyses performed for this study, each subfunction category was evaluated and scores averaged to yield a total score for the function category. Fourteen function categories were evaluated (Table C.1-1), each with a maximum value of 4. Thus, the maximum possible score for a wetland, based on 14 function categories, is 56 and the minimum score is 14.

C.3 WEP Results

The majority (92%) of the individual wetlands on the project site are <25 acres in size, simplistic to slightly complex in vegetation diversity and structure, and hydrologically isolated (Section 3.3.9). Only 8% of the wetlands account for nearly 76% of the total 24,735 acres of wetlands. Eleven wetlands, considered representative of the range of wetlands on the project site, were selected for detailed evaluation using WEP (see Section 4.0 for physical characteristics and locations). Prior to the evaluation, each wetland was delineated and classified, as

were all other wetlands on the project site (Section 3.3.3), according to the Florida Land Use and Cover Classification System (Fla. Dept. of Admin. 1976) and the U.S. Fish and Wildlife Service classification (Cowardin et al. 1979). Additionally, vegetation transects were run through each of the eleven selected wetlands to characterize dominant species, community structure, and general features (see Section 3.3.11 for methodology and Section 4.0 for results).

C.3.1 Natural Biological Functions

C.3.1.1 Food Chain Production

Three components were evaluated under the food chain production subfunction category: net primary productivity, mode of detrital transport, and food chain support.

Net Primary Productivity. Because different vegetation associations within a single wetland unit usually have different net productivity values, mean net productivity of each wetland was determined by summing the percent area occupied by each vegetation association multiplied by its particular net primary productivity value. Based on the evaluation criteria, the majority of the wetlands evaluated were numerically rated with a score of 1 for net primary productivity (Table C.3-1). Three of the larger, generally more diverse wetlands with weak hydrological connections were rated as 2.

Mode of Detrital Transport. Transport of detrital material and nutrients in detrital-based food chains is particularly dependent on the degree of hydrological connection to flowing water systems. The evaluation results indicate that all the evaluated wetlands contain varying amounts of detrital material but are either hydrologically isolated or, at best, have weak hydrological connections (Table C.3-2). Therefore, the wetlands are not able to contribute significantly to detrital-based food chains in downstream systems; thus, the majority of wetlands evaluated were assigned a score of 1.

Food Chain Support. Evaluation of this function was based primarily on net productivity, potential litterfall and decomposition rates of litterfall material which determine rate of availability to consumer organisms and potential for faunal utilization. Based on the evaluation criteria, all the selected wetlands were rated 2 for this function (Table C.3-3).

C.3.1.2 General and Specialized Habitat

Wetlands provide habitat for a variety of aquatic, semi-aquatic, and terrestrial animals, depending on the wetland's ability to provide the necessary ecological requirements of each animal species and the degree of disturbance to the habitat, such as adjacent land use, fire, logging, and drainage. Habitat quality of each wetland was evaluated using two sets of criteria:

Table C.3-1. Net Primary Productivity Values for Wetlands in the OXY Project Area.

Wetland	Vegetation Association	Percent[1]	Hydrologic Condition[2]	Estimated NPP[3]	Score
2734	Cypress-swamp tupelo	100	ST	800	1
2696	Cypress-swamp tupelo	100	ST	800	1
2014	Mixed hardwoods	42.4	SL	996	2
	Cypress-swamp tupelo	. 8.0			
	Cypress-cypress/pine	35.1			
	Cypress-mixed hardwoods	7.3			
	Marsh	7.2			
1370	Cypress-swamp tupelo	100	ST	800	1
1227	Cypress-swamp tupelo	100	ST	800	1
1378	Cypress-swamp tupelo	72	SL	1164	2
	Mixed hardwoods	28	SL		
1690	Cypress-swamp tupelo	100	ST	800	1
1175	Cypress-swamp tupelo	100	ST	800	1
2275	Cypress-swamp tupelo	100	ST	800	1
2139	Cypress-swamp tupelo	100	ST	800	1
2550	Cypress-mixed hardwoods	100	SL	1200	2

[1]Percent of area occupied by the primary vegetation association.
[2]SL = sluggish water ST = still water
[3]NPP = net primary productivity.

NPP = The sum of (vegetation association NPP x percentage of area occupied by the vegetation association).

Table C.3-2. Evaluation of Mode of Detrital Transport.

Wetland	Hydrological Criteria	Score
2734	Isolated	1
2696	Isolated	1
2014	Linked to intermittent watercourse	3
1370	Isolated	1
1227	Isolated	1
1378	Linked to ephemeral stream system	2
1690	Isolated	1
1175	Isolated	1
2275	Isolated	1
2139	Isolated	1
2550	Bisected by seasonal or perennial watercourse, but hydrologically isolated by berms	1

Table C.3-3. Food Chain Support Evaluation Results.

Wetland	Net Productivity*	Decomposition Rate	Potential for Faunal Utilization	Score
2734	1	Moderate	Low	2
2696	1	Moderate	Moderate	2
2014	2	Moderate	High	2
1370	1	Moderate	Low	2
1227	1	Moderate	Moderate	2
1378	2	Moderate	Moderate	2
1690	1	Moderate	Moderate	2
1175	1	Moderate	Low	2
2275	1	Moderate	Low	2
2139	1	Moderate	Moderate	2
2550	2	Moderate	High	2

*From Table C.3-1.

1) abiotic and biotic characteristics, and
2) utilization of the wetlands by selected species, based on their ecological requirements.

C.3.1.2.1 Abiotic and Biotic Characteristics

Eleven characteristics were evaluated as part of the general and specialized habitat component of WEP. Nine of the eleven wetlands had a score of 2 for this component (Table C.3-4). None of the eleven characteristics evaluated appeared to be key in separating wetland rankings. In fact, all characteristics, with the exception of wetland contiguity, overstory coverage (%), and wetland type, were highly variable.

C.3.1.2.2 Utilization by Selected Species

The majority of the wetlands evaluated (6 of 11) received a score of 2 (Tables C.3-5 and C.3-6). The majority of wetlands would have scored higher had there been significant permanent water sources within the wetlands to provide habitat for fish and amphibians.

C.3.2 Hydrologic Support Function

This function was evaluated based on hydrologic periodicity and location within the drainage area.

C.3.2.1 Hydrologic Periodicity

Based on the modified WEP criteria, the majority of wetlands evaluated received a score of 1 (Table C.3-7). These wetlands are palustrine and either hydrologically isolated or weakly connected to other wetland systems by short flow during extreme precipitation events.

C.3.2.2 Location or Elevation Within Wetland System

The majority of wetlands received a WEP score of 1 because of their hydrological isolation (Table C.3-7).

C.3.3 Storage for Storm and Flood Waters

This function is rated in terms of the 1) areal extent of the wetland as a percentage of the total drainage area for flood storage and 2) percent vegetation cover for flood retardation. The numerical ratings equate to potential for flood damage protection.

Flood Storage. All evaluated wetlands, with the exception of Wetlands 2014 and 2550, received a score of 1 for this component (Table C.3-8), because each comprises an extremely small percentage of its drainage area. Wetlands 2014 and 2550 received higher scores because they comprise a larger percentage of their respective total drainage areas than the other wetlands evaluated.

Flood Retardation. All wetlands received a score of 4 for flood retardation (Table C.3-8) as a result of the high percentage of cover by woody and shrub species.

Table C.3-4. Summary Comments and Scores* for Abiotic and Biotic Characteristics.

Parameter	Wetland No. 2734		2696		2014		1370		1227		1378	
	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score
Wetland size	8 ac	0.36	35 ac	0.48	6400 ac	1.00	2 ac	0.09	40 ac	0.48	235 ac	0.75
Wetland contiguity	Isolated	0.10	Isolated	0.10	Ditched connection	0.20	Isolated	0.10	Isolated	0.10	Ditched connection	0.20
Wetland type	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76	Mixed hardwoods	0.80	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76
Edge-to-area ratio	CEI=1593.34	0.25	CEI=1844.22	0.32	CEI=4196.14	1.00	CEI=1318.34	0.17	CEI=1625.00	0.25	CEI=2635.91	0.55
Structural diversity	3 strata 2 zones	0.80	3 strata 2 zones	0.80	3 strata 3 zones	0.90	3 strata 3 zones	0.90	3 strata 2 zones	0.80	3 strata 2 zones	0.80
Percent overstory coverage	$\bar{x}$ = 79.0 (10 plots)	0.99	$\bar{x}$ = 81.2 (32 plots)	0.99	$\bar{x}$ = 76.5 (39 plots)	1.00	$\bar{x}$ = 77.5 (4 plots)	0.99	$\bar{x}$ = 78.6 (25 plots)	0.99	$\bar{x}$ = 68.57 (42 plots)	1.00
Percent inundation	20	0.44	5	0.12	50	0.80	5	0.12	5	0.12	60	0.80
Percent ground cover	$\bar{x}$ = 100.0 (10 plots)	0.80	$\bar{x}$ = 7.3 (32 plots)	0.16	$\bar{x}$ = 26.2 (39 plots)	0.48	$\bar{x}$ = 5.0 (4 plots)	0.12	$\bar{x}$ = 6.2 (25 plots)	0.14	$\bar{x}$ = 1.00 (42 plots)	0.02
Percent understory	$\bar{x}$ = 19.7 (10 plots)	0.38	$\bar{x}$ = 62.3 (32 plots)	0.85	$\bar{x}$ = 32.9 (39 plots)	0.58	$\bar{x}$ = 8.8 (4 plots)	0.20	$\bar{x}$ = 70.2 (25 plots)	0.89	$\bar{x}$ = 27.57 (42 plots)	0.46
No. trees ≥16 in dbh	$\bar{x}$ = 0.4 (10 plots)	0.22	$\bar{x}$ = 0.38 (32 plots)	0.22	$\bar{x}$ = 0.28 (39 plots)	0.24	$\bar{x}$ = 0 (4 plots)	0	$\bar{x}$ = 0.08 (25 plots)	0.42	$\bar{x}$ = 0.60 (42 plots)	0.30
No. standing dead trees	$\bar{x}$ = 0.6 (10 plots)	0.76	$\bar{x}$ = 0.38 (32 plots)	0.64	$\bar{x}$ = 0.54 (39 plots)	0.74	$\bar{x}$ = 0 (4 plots)	0	$\bar{x}$ = 1.4 (25 plots)	0.96	$\bar{x}$ = 0.64 (42 plots)	0.76
Total Score	-	5.86	-	5.44	-	7.74	-	3.45	-	5.91	-	6.40
WEP Score		2		2		3		1		2		2

Table C.3-4 (Continued).

Parameter	Wetland No. 1690 Comment	1690 Score	1175 Comment	1175 Score	2275 Comment	2275 Score	2139 Comment	2139 Score	2550 Comment	2550 Score
Wetland size	55 ac	0.54	3 ac	0.10	3 ac	0.10	45 ac	0.51	1500 ac	1.00
Wetland contiguity	Isolated	0.10	Isolated	0.10	Isolated	0.10	Isolated	0.10	Ditched connection	0.20
Wetland type	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76	Cypress-swamp tupelo	0.76
Edge-to-area ratio	CEI=2613.03	0.54	CEI=1236.71	0.14	CEI=1093.11	0.10	CEI=1950.39	0.35	CEI=2575.08	0.53
Structural diversity	3 strata 1 zone	0.70	3 strata 2 zones	0.80	2 strata 1 zone	0.40	3 strata 2 zones	0.80	3 strata 2 zones	0.80
Percent overstory coverage	$\bar{x}$ = 84.6 (38 plots)	0.98	$\bar{x}$ = 82.5 (6 plots)	0.98	$\bar{x}$ = 90.0 (7 plots)	0.96	$\bar{x}$ = 78.3 (27 plots)	0.99	$\bar{x}$ = 89.4 (142 plots)	0.96
Percent inundation	50	0.80	20	0.42	0	0	5	0.12	20	0.44
Percent ground cover	$\bar{x}$ = 1.7 (38 plots)	0.06	$\bar{x}$ = 42.5 (6 plots)	0.68	$\bar{x}$ = 0 (7 plots)	0	$\bar{x}$ = 1.8 (27 plots)	0.04	$\bar{x}$ = 5.7 (142 plots)	0.12
Percent understory	$\bar{x}$ = 47.5 (38 plots)	0.74	$\bar{x}$ = 40.0 (6 plots)	0.66	$\bar{x}$ = 61.4 (7 plots)	0.84	$\bar{x}$ = 52.6 (27 plots)	0.78	$\bar{x}$ = 10.0 (142 plots)	0.22
No. trees ≥16 in dbh	$\bar{x}$ = 0.58 (38 plots)	0.36	$\bar{x}$ = 0 (6 plots)	0.00	$\bar{x}$ = 0.29 (7 plots)	0.16	$\bar{x}$ = 1.07 (27 plots)	0.46	$\bar{x}$ = 0.8 (142 plots)	0.50
No. standing dead trees	$\bar{x}$ = 0.58 (38 plots)	0.74	$\bar{x}$ = 0.7 (6 plots)	0.80	$\bar{x}$ = 0.57 (7 plots)	0.74	$\bar{x}$ = 1.15 (27 plots)	0.92	$\bar{x}$ = 0.56 (142 plots)	0.74
Total Score	-	6.32	-	5.44	-	4.16	-	5.83	-	6.27
WEP Score		2		2		2		2		2

*Possible score is 1.00 for each parameter; therefore, total possible score is 11.00.

Table C.3-5. Summary of Selected Species Utilization Evaluation for Cypress-Swamp Tupelo Wetlands.

Species	Wetland Score*									
	2734	2696	1370	1227	1378	1690	1175	2275	2139	2550
FISH										
Redfin pickerel	0	0	0	0	0	0	0	0	0	1
Eastern mud minnow	0	0	0	0	0	0	1	0	0	3
Pirate perch	0	0	0	0	0	0	0	0	0	3
Mud sunfish	0	0	0	0	0	0	0	0	0	2
Swamp darter	0	0	0	0	0	0	1	0	0	3
Golden topminnow	0	0	0	0	0	0	1	0	0	3
Least killifish	0	0	0	0	0	0	0	0	0	3
Flagfish	0	0	0	0	0	0	2	0	0	3
Banded pygmy sunfish	0	0	0	0	0	0	0	0	0	3
Warmouth	0	0	0	0	0	0	0	0	0	3
AMPHIBIANS										
Eastern lesser siren	1	1	0	2	3	1	1	0	1	3
Flatwoods salamander	2	2	1	2	3	2	2	1	2	2
Pine woods treefrog	3	2	1	2	3	3	1	1	3	3
Bullfrog	0	0	0	1	3	1	0	0	0	3
Pig frog	1	1	1	2	3	2	1	1	1	3
REPTILES										
Florida mud turtle	2	2	1	3	3	3	3	2	2	3
Eastern glossy water snake	1	1	1	3	3	1	1	1	1	3
Black swamp snake	1	2	1	3	3	2	0	1	2	3
Eastern indigo snake	0	0	0	1	2	1	0	0	0	2
Florida cottonmouth	2	2	1	3	3	3	1	1	3	3
BIRDS										
Wading birds (Ciconiiformes)	1	1	1	1	1	1	1	1	1	2
Wood duck	1	0	0	2	3	1	0	0	0	3
Red-shouldered hawk	1	1	1	2	3	2	1	0	1	3
Turkey	0	1	0	1	1	1	0	0	1	3
Barred owl	1	2	1	3	3	2	1	1	2	3
Red-bellied woodpecker	1	1	0	1	3	2	1	0	2	3
Tufted titmouse	1	2	1	2	3	1	1	1	2	3
Carolina wren	2	2	1	2	3	2	2	2	2	3
White-eyed vireo	2	2	1	2	3	2	2	2	2	3
Warblers (Parulidae)	2	1	1	2	3	2	1	2	2	3
MAMMALS										
Eastern woodrat	1	1	0	1	2	1	0	0	1	3
Eastern gray squirrel	1	1	1	2	3	2	1	1	2	3
Cotton mouse	2	2	1	2	2	3	1	1	2	3
Marsh rice rat	0	1	0	1	2	1	0	0	0	1
White-tailed deer	1	1	0	2	2	2	0	1	1	3
Total Score	30	32	16	48	66	44	27	20	36	93
WEP Score	2	2	1	2	3	2	2	1	2	4

*Possible score is 3 for each species; therefore, total possible score is 105.

Table C.3-6. Summary of Selected Species Utilization Evaluation for Wetland 2014 (Mixed Hardwoods).

Species	Score*	Species	Score*
FISH		BIRDS	
Redfin pickerel	3	Wading birds (Ciconiiformes)	2
Eastern mud minnow	3	Wood duck	3
Pirate perch	3	Swallow-tailed kite	2
Mud sunfish	3	Red-shouldered hawk	3
Swamp darter	3	Yellow-billed cuckoo	3
Golden topminnow	3	Barred owl	3
Least killifish	3	Woodpeckers	2
Flagfish	3	Acadian flycatcher	3
Banded pygmy sunfish	3	White-eyed vireo	3
Warmouth	3	Warblers (Parulidae)	3
AMPHIBIANS		MAMMALS	
Greater siren	3	Bats	2
Two-toed amphiuma	3	Eastern gray squirrel	2
River frog	3	Otter	3
Bronze frog	3	Florida black bear	3
		Wild hog	3
REPTILES			
Alligator	2		
Striped mud turtle	3		
Brown water snake	3		
Eastern mud snake	3		
Florida cottonmouth	3		
		TOTAL SCORE	96
		WEP SCORE	4

*Possible score is 3 for each species; therefore, total possible score is 102.

Table C.3-7. Hydrologic Support Function Evaluation Results.

Wetland	Condition	Hydrologic Periodicity	Location or Elevation Within Wetland System
2734	Isolated wetland	1	1
2696	Isolated wetland	1	1
2014	Normally or seasonally flooded wetland connected to intermittent streams	2	2
1370	Isolated	1	1
1227	Isolated	1	1
1378	Intermittently to normally flooded system connected to ephemeral or intermittent watercourse	2	2
1690	Isolated	1	1
1175	Isolated	1	1
2275	Isolated	1	1
2139	Isolated	1	1
2550	Bisected by watercourse; physically isolated by berms	1	1

Table C.3-8. Evaluation of Storm and Flood Water Storage Function.

Wetland	Flood Storage		Flood Retardation	
	% Area of Wetlands*	Score	% Vegetation Cover	Score
2734	0.02	1	>80	4
2696	0.1	1	>80	4
2014	12.0	3	>80	4
1370	0.02	1	>80	4
1227	0.5	1	>80	4
1378	2.6	1	>80	4
1690	0.8	1	>80	4
1175	0.02	1	>80	4
2275	0.05	1	>80	4
2139	0.7	1	>80	4
2550	10.6	2	>80	4

*Area of wetlands as a percentage of total drainage area.

C.3.4 Natural Groundwater Recharge

Wetlands may serve both as groundwater recharge areas and groundwater discharge areas. Often during normal or particularly wet periods, wetlands are groundwater discharge or intercept zones. In drier conditions, wetlands could serve as recharge areas by contributing to underlying or adjacent aquifers depending on local soil and geologic conditions. They could also serve as discharge receiving areas, depending on elevations of the Surficial Aquifer and water elevations in the wetland.

Using the WEP evaluation criteria, all the wetlands evaluated, with the exception of Wetlands 2014, 1378, and 2550, comprise <2% of their total drainage areas, which equates to a low value for groundwater recharge (Table C.3-9). Wetlands 2550 and 2014 were rated high as a percent of the total drainage area but rated low in their hydrological characteristics. Well drilling and soil borings data show that wetlands on the project site typically are underlain by hardpan, limiting recharge to lower aquifers (e.g., Floridan). The ability of these wetlands to recharge surficial aquifers is limited due to the lack of water in many of the wetlands during dry periods and evapotranspiration from the wetlands.

C.3.5 Water Purification Through Natural Water Filtration

Each wetland was evaluated in terms of its water quality enhancement efficiency. Eight factors, including wetland size, vegetation density, and hydrological condition of the wetland, were considered in the evaluation.

1) Wetland Type

   a) Hydroperiod. All wetlands evaluated are palustrine in nature and, except for Wetland 2014, received a score of 1 based on the modified WEP criteria (Table C.3-10). Due to its hydrological connection, Wetland 2014 received a score of 2.

   b) Vegetation Density. Field studies indicated vegetation density of all wetlands, based on percent canopy cover, is >80%, resulting in a numerical rating of 4.

2) Areal and Waste-Loading Relationships

   a) Total Wetland Size. Acreages of the evaluated wetlands range from 2 acres for Wetland 1370 to 6400 acres for Wetland 2014; corresponding scores range from 1 to 4 (Table C.3-10).

   b) Proportion of Water Surface Area to Wetland Area. The percentage of open water was estimated as being inversely proportional to the percent ground cover. The majority of wetlands evaluated have a low percentage of ground cover (Table C.3-10). This results in a high percentage of open area which could conceivably have open water during the limited time these wetlands are inundated. In some cases,

Table C.3-9. Natural Groundwater Recharge Evaluation Results.

Wetland	% of Drainage Area	Recharge* (in/yr)	Score
2734	0.02	0.2-0.02	1
2696	0.10	0.2-0.02	1
2014	12.0	0.2-0.02	2
1370	0.02	0.2-0.02	1
1227	0.5	0.2-0.02	1
1378	2.6	0.2-0.02	1
1690	0.8	0.2-0.02	1
1175	0.02	0.3-0.03	1
2275	0.05	0.6-0.06	1
2139	0.7	0.6-0.06	1
2550	10.6	0.4-0.04	2

*See Section 3.4.3.

Table C.3-10. Results of Water Quality Enhancement Evaluation.

Function	Wetland No. 2734		2696		2014		1370		1227		1378	
	Comment*	Score	Comment*	Score	Comment*	Score	Comment*	Score	Comment*	Score	Comment*	Score
Wetland Type												
Hydroperiod	P	1	P	1	P	2	P	1	P	1	P	1
Vegetation Density	>80%	4	>80%	4	>80%	4	>80%	4	>80%	4	>80%	4
Areal and Waste-Loading Relationships												
Total Size	8 ac	1	35 ac	2	6400 ac	4	2 ac	1	40 ac	2	235 ac	4
Proportion of Water Surface to Wetland Area	<40%	4	>75%	1	61-75%	2	>75%	1	>75%	1	>75%	1
Overland Runoff Retained in System	<25%	2	<25%	2	<25%	2	<25%	2	<25%	2	<25%	2
5-day BOD Loading	<5 lb	4	<5 lb	4	5-15 lb	4	<5 lb	4	<5 lb	4	<5 lb	4
Geographical and Other Locational Factors												
Frost-free days	>250 days	4	>250 days	4	>250 days	4	>250 days	4	>250 days	4	>250 days	4
Proximity to Pollution Sources	N	1	N	1	N	1	N	1	N	1	N	1

Table C.3-10 (Continued).

Function	Wetland No. 1690 Comment*	1690 Score	1175 Comment*	1175 Score	2275 Comment*	2275 Score	2139 Comment*	2139 Score	2550 Comment*	2550 Score
Wetland Type										
Hydroperiod	P	1	P	1	P	1	P	1	P	1
Vegetation Density	>80%	4	>80%	4	>80%	4	>80%	4	>80%	4
Areal and Waste-Loading Relationships										
Total Size	55 ac	2	3 ac	1	3 ac	1	45 ac	2	1500 ac	4
Proportion of Water Surface to Wetland Area	>75%	1	40-60%	3	>75%	1	>75%	1	>75%	1
Overland Runoff Retained in System	<25%	2	<25%	2	<25%	2	<25%	2	<25%	2
5-day BOD Loading	<5 lb	4	<5 lb	4	<5 lb	4	<5 lb	4	<5 lb	4
Geographical and Other Locational Factors										
Frost-free days	>250 days	4	>250 days	4	>250 days	4	>250 days	4	>250 days	4
Proximity to Pollution Sources	N	1	N	1	N	1	N	1	S	2

*P = palustrine.
N = not strategically located.
S = strategically located.

the wetlands only have saturated soil and are never truly inundated. WEP criteria do not effectively deal with situations such as this; as vegetation density increases, vegetation diversity often decreases, ultimately resulting in monocultures, which are ecologically as well as aesthetically undesirable. Furthermore, increased vegetation coverage reduces habitat for algal species and decreases aeration from wind action which would affect the water purification ability of the wetland system.

c) Proportion of Overland Runoff Retained in System. The wetland systems evaluated are either hydrologically isolated or weakly tied. Even the larger wetlands do not account for a significant portion of their respective drainage areas and thus would not be subject to a large amount of runoff being held or passing through the wetland. Therefore, the majority of wetlands evaluated received a score of 2 for this component (Table C.3-10).

d) Five-Day BOD Loading. All wetlands received a score of 4 for this component (Table C.3-10).

3. Geographic and Other Locational Factors

a) Frost-free Days. Due to Florida's relatively mild climate, there are >250 frost-free days in the project area. Thus, based on WEP criteria, all wetlands evaluated received a score of 4 for this component (Table C.3-10).

b) Location with Reference to Known Pollution Sources. All wetlands evaluated, except Wetland 2550, are not strategically located with reference to known pollution sources and therefore received a score of 1 for this component. Wetland 2550 is bisected by a ditch which receives permitted industrial discharge.

C.3.6 Cultural Values

C.3.6.1 Socioeconomic Benefits and Renewable Resources

Renewable Resources and Agriculture. The majority of wetlands evaluated have been logged of merchantable cypress in the past 10-25 years. The exception is Wetland 2014, which has been and still is being logged. No agricultural operations are being conducted in any of the evaluated wetlands. The general project area does receive some rather insignificant pressure from local trappers for fur-bearing species. The majority of wetlands, except for small systems (<5 acres), do have potential for future silvicultural use, and the larger wetlands (>200 acres) have potential for immediate use (Table C.3-11).

Table C.3-11. Cultural Values Based on WEP Method.

Wetland	Socioeconomic Benefits and Renewable Resources	Recreation	Aesthetics	Historical and Archaeological Importance
2734	1	1	2	1
2696	2	2	2	1
2014	3	2	4	1
1370	1	1	2	1
1227	2	2	2	1
1378	3	2	2	1
1690	2	2	2	1
1175	1	1	2	1
2275	1	1	2	1
2139	2	2	2	1
2550	3	2	3	2

C.3.6.2 Culturally Perceived Values

Recreation. No wetlands on the project site are considered significant recreational areas. The evaluated wetlands do not support sport fisheries, and their inaccessibility and dense vegetation seemingly preclude use as wilderness retreats. These wetlands are used by game species to some extent, but the wetlands themselves would receive limited use as hunting areas. The small wetlands evaluated (<10 acres) received a score of 1 for this component; all others scored 2.

Aesthetics. The wetlands on the project site have been subjected to various degrees of disturbance including logging, fire, and drainage. These disturbances result in a decrease in value of the aesthetic qualities of the wetlands. Additionally, adjacent land uses such as silviculture operations and clearcutting further reduce the aesthetic value. The wetlands are located in non-urban areas providing a degree of "remoteness," with many accessible only by foot. The majority of wetlands evaluated, except Wetlands 2014 and 2550, received a score of 2 (Table C.3-11). Wetlands 2014 and 2550 received scores of 4 and 3, respectively, due to the degree of isolation afforded by their large size, diversity of habitats, and "feeling of remoteness."

Historical and Archaeological Importance. No historical or archaeological sites are known to occur within any of the evaluated wetlands. However, two sites were found bordering Wetland 2550 (Section 3.8). These two sites represent hunting camps or special use camps of the Late Archaic or possibly Weeden Island period. However, they are not significant finds and are not recommended for preservation or project mitigation. Based on these findings, all wetlands evaluated, with the exception of Wetland 2550, received scores of 1 (Table C.3-11). Wetland 2550 received a 2 rating for this component due to the discovery of the two sites bordering this wetland. A higher value would have been given this wetland had the sites been of significance or recommended for preservation or project mitigation.

C.3.7 Special Values

C.3.7.1 Habitat for Rare, Restricted, and Relic Flora and Fauna

All evaluated wetlands have the potential to provide habitat for rare species (see Section 3.3.7). However, the majority of wetlands evaluated are of low habitat quality and are too small to support viable populations of many of these species and thus received a numerically lower rating (Table C.3-12). The larger and more vegetatively complex wetlands, Wetlands 2014 and 2550, do have the potential habitat area and quality to support these species and thus received higher scores. Some of the listed species were observed in Wetland 2014.

C.3.7.2 Other Considerations

Shoreline protection is one function that wetlands may perform. Although none of the evaluated wetlands fulfills this function, specific parameters related to shoreline protection were evaluated based on the WEP criteria (Table C.3-13).

Table C.3-12. Evaluation of Habitat for Rare, Restricted, and Relic Flora and Fauna.

Wetland	Habitat for Rare, Restricted, and Relic Flora and Fauna
2734	1
2696	2
2014	4
1370	1
1227	2
1378	2
1690	2
1175	1
2275	1
2139	2
2550	3

Table C.3-13. Evaluation Results for Shoreline Protection Components.

Wetland No.	Type of Wetland Vegetation	Density of Total Vegetation Community	Width of Wetland	Fetch	Cultural Usage
2734	4	4	4	1	1
2696	4	4	4	1	1
2014	4	4	4	1	1
1370	4	4	4	1	1
1227	4	4	4	1	1
1378	4	4	4	1	1
1690	4	4	4	1	1
1175	4	4	4	1	1
2275	4	4	4	1	1
2139	4	4	4	1	1
2550	4	4	4	1	1

C.4 WEP Evaluation Summary

Scores for each function and subfunction for each of the eleven wetlands evaluated are presented in Table C.4-1. Based on a scale of 14 to 56, all but one of the wetlands evaluated using the modified WEP methodology had total scores <35 (Table C.4-2). The largest wetland, Bee Haven Bay, had a total score of 39.16. This wetland is vegetatively complex and large (approximately 6400 acres).

The majority (92%) of the 1762 individual wetlands on the project site are small (<25 acres), hydrologically isolated, and/or simplistic in vegetation structure and diversity. The larger, weakly linked wetland systems, which are few in total number but account for 76% of the total wetland acreage on site, would rate higher in their wetland value.

C.5 Federal Highway Administration (FHWA) Method

Based on input from coordinating agencies, an alternative method was also used to evaluate wetlands in the OXY project area. The Federal Highway Administration method (Adamus 1983) was chosen for several reasons. Like WEP, it incorporates the five elements (habitat, hydrology, recreation, agriculture/silviculture, and heritage) that Lonard et al. (1981) considered important in assessment of wetland functional values. The functions evaluated with this method are presented in Table C.5-1. The FHWA method considers a wide variety of wetland types and is applicable over a broad geographical range. The procedure has been reviewed by several agencies and individuals considered among the top wetland scientists in the U.S. Their review and comments were published by the U.S. Fish and Wildlife Service (FWS 1984).

Procedure I (Threshold Analysis) of the FHWA method was used to evaluate the same 11 wetlands selected for analysis using the Reppert et al. (1979) WEP methodology as well as to evaluate projected post-reclamation wetland types. Form C was not used as it relates specifically to impacts due to highway projects.

Procedure II (Comparative Analysis) was not used because its purpose is to differentiate between two or more wetlands which received the same ratings under Procedure I. The procedure is applicable only when trying to decide which among a specified group of wetlands provides the least benefit or value to the area. Therefore, Procedure II is not applicable at this point in time. The purpose of the wetland evaluations was to provide a general evaluation of the wetlands within the project site. This goal was met through use of Procedure I.

Procedure III (Mitigation Analysis) was not used because, like Form C in Procedure I, it is specific to highway projects.

Because the methodology was not modified from the original procedure as published, only a general outline of the procedure is presented herein. A detailed discussion of the methodology can be found in Adamus (1983).

Table C.4-1. WEP Rating Scores for Function and Subfunction Categories.

Functional Area/Function/Subfunction*	Wetland										
	2734	2696	2014	1370	1227	1378	1690	1175	2275	2139	2550
I. Natural Biological Functions											
A. Food chain production	1.33	1.33	2.33	1.33	1.33	2.00	1.33	1.33	1.33	1.33	1.67
1. Net primary productivity	1	1	2	1	1	2	1	1	1	1	2
2. Mode of detrital transport	1	1	3	1	1	2	1	1	1	1	1
3. Food chain support	2	2	2	2	2	2	2	2	2	2	2
B. General and specialized habitat	2.00	2.00	3.50	1.50	2.00	3.00	2.50	2.00	1.50	2.00	3.50
1. Abiotic/biotic characteristics	2	2	3	2	2	3	3	2	2	2	3
2. Evaluation of usage by selected species	2	2	4	1	2	3	2	2	1	2	4
II. Hydrologic Support Function											
A. Hydrologic periodicity	1.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
B. Location or elevation within wetland system	1.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
III. Storage for Storm and Flood Waters											
A. Wetlands as % of area watersheds	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00
B. % vegetation cover of wetland	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
IV. Natural Groundwater Recharge	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00
V. Water Purification											
A. Wetland type	2.50	2.50	3.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
1. Hydroperiod	1	1	2	1	1	1	1	1	1	1	1
2. Vegetation density	4	4	4	4	4	4	4	4	4	4	4
B. Areal/waste loading relationships	2.75	2.25	3.00	2.00	2.25	2.75	2.25	2.50	2.00	2.25	2.75
1. Total wetland size	1	2	4	1	2	4	2	1	1	2	4
2. Proportion of water surface area to wetland area runoff	4	1	2	1	1	1	1	3	1	1	1
3. Proportion of river volume flowing through or overland runoff retained	2	2	2	2	2	2	2	2	2	2	2
4. 5-day BOD loading	4	4	4	4	4	4	4	4	4	4	4

Table C.4-1 (Continued).

Functional Area/Function/Subfunction*	Wetland										
	2734	2696	2014	1370	1227	1378	1690	1175	2275	2139	2550
C. Geographic and other locational factors	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	3.00
1. Frost-free days	4	4	4	4	4	4	4	4	4	4	4
2. Location with reference to known pollution sources	1	1	1	1	1	1	1	1	1	1	2
VI. Cultural Values											
A. Socioeconomic benefits and renewable resources	1.00	2.00	3.00	1.00	2.00	3.00	2.00	1.00	1.00	2.00	3.00
B. Culturally perceived values	1.33	1.67	2.33	1.33	1.67	1.67	1.67	1.33	1.33	1.67	2.33
1. Recreation	1	2	2	1	2	2	2	1	1	2	2
2. Aesthetics	2	2	4	2	2	2	2	2	2	2	3
3. Historical/archaeological importance	1	1	1	1	1	1	1	1	1	1	2
VII. Special Values											
A. Habitat for rare, restricted, and relic flora and fauna	1.00	2.00	4.00	1.00	2.00	2.00	2.00	1.00	1.00	2.00	3.00
B. Other considerations (shoreline protection)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
1. Vegetation characteristics	4	4	4	4	4	4	4	4	4	4	4
a. Type of wetland vegetation	4	4	4	4	4	4	4	4	4	4	4
b. Density of total vegetation community	4	4	4	4	4	4	4	4	4	4	4
2. Width of wetland vegetation	4	4	4	4	4	4	4	4	4	4	4
3. Fetch	1	1	1	1	1	1	1	1	1	1	1
4. Cultural usage	1	1	1	1	1	1	1	1	1	1	1

*Function scores calculated as average of subfunction scores (Table C.1-1).

Table C.4-2. Summary of WEP Function Evaluation Scores.*

Function	Wetland										
	2734	2696	2014	1370	1227	1378	1690	1175	2275	2139	2550
Food chain production	1.33	1.33	2.33	1.33	1.33	2.00	1.33	1.33	1.33	1.33	1.67
General and specialized habitat	2.00	2.00	3.50	1.50	2.00	3.00	2.50	2.00	1.50	2.00	3.50
Hydrologic periodicity	1.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
Location or elevation within wetland system	1.00	1.00	2.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
Flood storage	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00
Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Natural groundwater recharge	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00
Wetland type	2.50	2.50	3.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Areal and waste-loading relationships	2.75	2.25	3.00	2.00	2.25	2.75	2.25	2.50	2.00	2.25	2.75
Geographic and other locational factors	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	3.00
Socioeconomic benefits and renewable resources	1.00	2.00	3.00	1.00	2.00	3.00	2.00	1.00	1.00	2.00	3.00
Culturally perceived values	1.33	1.67	2.33	1.33	1.67	1.67	1.67	1.33	1.33	1.67	2.33
Habitat for rare, restricted, and relic flora and fauna	1.00	2.00	4.00	1.00	2.00	2.00	2.00	1.00	1.00	2.00	3.00
Shoreline protection	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
TOTAL	24.91	26.75	39.16	23.66	26.75	31.92	27.25	24.66	23.66	26.75	34.25

Score	Ranking
14-21	Very low (VL)
22-30	Low (L)
31-39	Moderate (M)
40-48	High (H)
49-56	Very high (VH)

NOTE: Rankings are only for comparison with those obtained using the Adamus (1983) procedure.

Table C.5-1. Wetland Attributes Evaluated with the FHWA Procedure (Adamus 1983).

Groundwater recharge
Groundwater discharge
Flood storage
Shoreline anchoring
Sediment trapping
Long-term nutrient retention
Seasonal nutrient retention
Downstream food chain support
In-basin food chain support
Fishery habitat (warm water, cold water, cold water riverine, anadromous riverine, selected species*)
Wildlife habitat (general diversity, waterfowl groups, selected species*)
Active recreation (swimming, boat launching, power boating, canoeing, sailing)
Passive recreation and heritage

*Evaluation for selected species based on answers to basic questions (FHWA Form A) plus sighting criteria (Adamus 1983).

C.6 FHWA Evaluation Procedure I: Threshold Analysis

Two forms (designated Form A and Form B in the handbook), provide a series of questions requiring either a "yes," "no," or "unknown" answer. Some questions are left unanswered if they are not applicable to the wetland being evaluated. For example, no answer would be given for a question concerning marine systems if the wetland being evaluated was a freshwater wetland. Form A contains a series of basic questions concerning the wetland system's physical, biological, and chemical characteristics. The answers to these questions are utilized in various function "keys" to determine the "effectiveness" and "opportunity" of the wetland function on a scale of high, moderate, or low (Figure C.6-1). The effectiveness rating result determines the probability that the wetland function is "...being productive in maximizing the opportunity given it to fulfill that function." Opportunity is defined as "...whether a wetland has a chance to fulfill a particular function." The "integration" of the effectiveness and opportunity results yields the "functional rating" or "functional value" of the wetland function on a scale of high, moderate, or low (Table C.6-1).

Form B also contains a series of questions to be answered "yes," "no," or "unknown." The answers to these questions are utilized in "keys" to determine the "significance" of the wetland function (Figure C.6-1). Significance is defined as "...the degree to which the performed function is valued by society, as partly reflected by its scarcity." The "integration" of the functional rating value and significance value yields the "functional significance" of the particular wetland function (Table C.6-1). The values for the functional significance may be rated as very high, high, moderate, low, or very low.

It should be noted that the FHWA procedure provides no opportunity rating for groundwater discharge due to the extensive geologic data needed to confirm this. Additionally, opportunity and effectiveness are considered the same for such wetland attributes as food chain support, fishery habitat, wildlife habitat, and active recreation. Passive recreation and heritage are not evaluated by the procedure for effectiveness and opportunity and therefore do not receive a functional rating.

C.7 FHWA Evaluation Results

C.7.1 Groundwater Recharge and Discharge

Results of the FHWA groundwater recharge and discharge function evaluations are presented in Tables C.7-1 and C.7-2. Groundwater recharge effectiveness and opportunity were rated as high in the majority of wetlands evaluated due to their lack of distinct surface water outlets; thus, water stands within the wetland and is lost through evapotranspiration and/or recharge. The opportunity rating for groundwater recharge is based solely on evapotranspiration-precipitation balance. For example, if evapotranspiration exceeds precipitation, opportunity is rated low. If precipitation exceeds evapotranspiration, opportunity is considered high. This does not take into account interflow in the upper Surficial Aquifer.

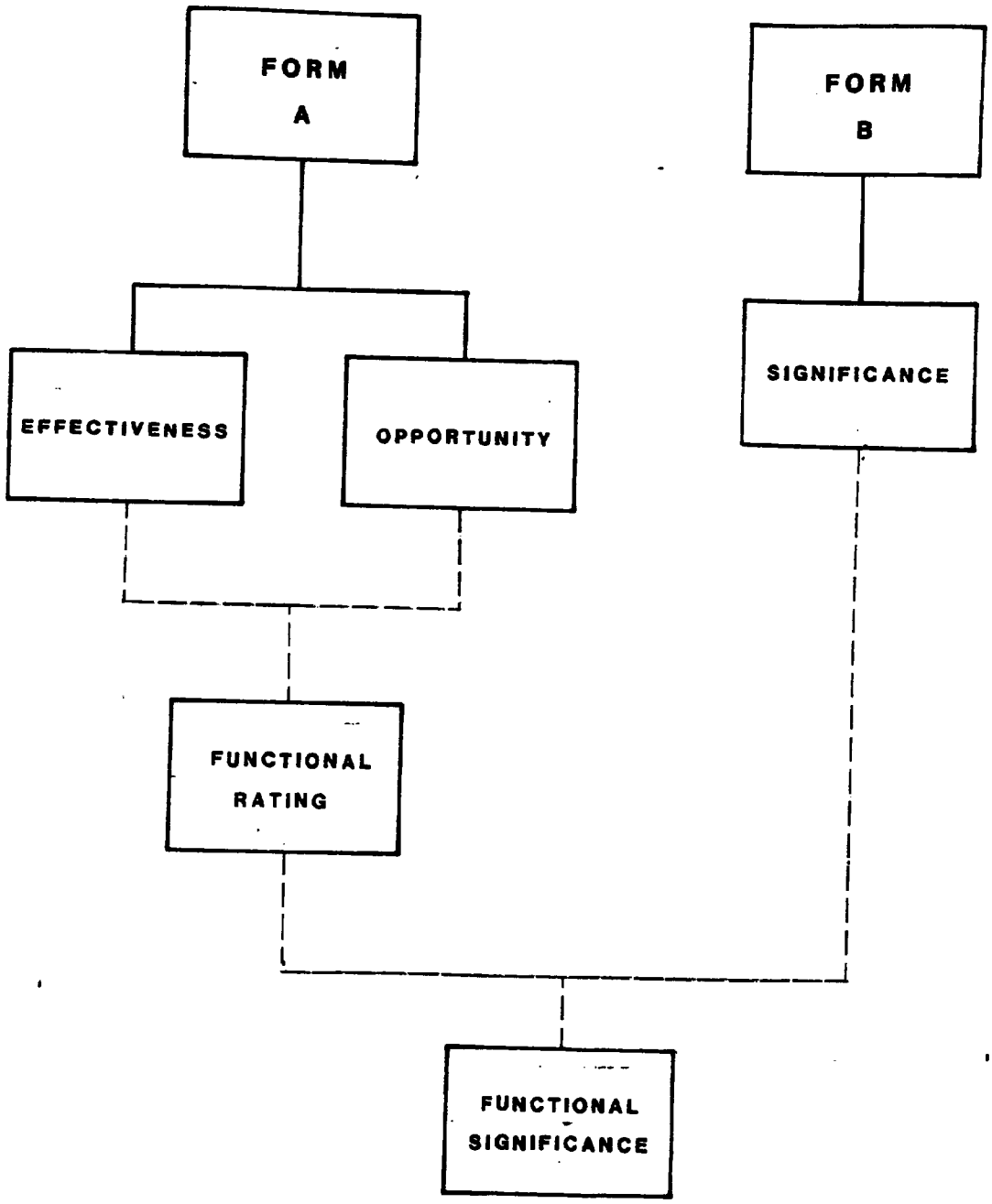


Figure C.6-1. Relationships to Determine Wetland Values Using the FHWA Method.

Table C.6-1. Determination of Functional Rating and Functional Significance Using the FHWA Method.

(If) Opportunity Rating	(And) Effectiveness Rating	(Then) Functional Rating
Determination of Functional Rating		
High	High	High
	Moderate	High
	Low	Moderate
Moderate	High	High
	Moderate	Moderate
	Low	Low
Low	High	Moderate
	Moderate	Moderate
	Low	Low

(If) Functional Rating	(And) Significance Rating	(Then) Functional Significance
Determination of Functional Significance		
High	High	Very high
	Moderate	High
	Low	Moderate
Moderate	High	High
	Moderate	Moderate
	Low	Moderate
Low	High	Low
	Moderate	Low
	Low	Very low

Source: Adamus 1983.

NOTE: For functions with a combined opportunity/effectiveness rating, the functional rating equals the opportunity/effectiveness rating.

Table C.7-1. Results of Groundwater Recharge Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	High	High	Low	Moderate
2696	High	High	High	Low	Moderate
2014	Low	High	Moderate	Low	Moderate
1370	High	High	High	Low	Moderate
1227	High	High	High	Low	Moderate
1378	High	High	High	Low	Moderate
1690	High	High	High	Low	Moderate
1175	High	High	High	Low	Moderate
2275	High	High	High	Low	Moderate
2139	High	High	High	Low	Moderate
2550	Low	High	Moderate	Low	Moderate

Table C.7-2. Results of Groundwater Discharge Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	Low	N/A	Low	Low	Very low
2696	Low	N/A	Low	Low	Very low
2014	Low	N/A	Low	Low	Very low
1370	Low	N/A	Low	Low	Very low
1227	Low	N/A	Low	Low	Very low
1378	Low	N/A	Low	Low	Very low
1690	Low	N/A	Low	Low	Very low
1175	Low	N/A	Low	Low	Very low
2275	Low	N/A	Low	Low	Very low
2139	Low	N/A	Low	Low	Very low
2550	Low	N/A	Low	Low	Very low

The significance value was rated low for groundwater recharge because of lack of official recognition, low demand on the aquifer in the region, low relative contribution of the evaluated area, and the availability of substitutes. It should be noted that all functions evaluated (Sections C.7.1 through C.7.10 received a low rating for significance for the same reasons. The exception is the general wildlife diversity function for Wetland No. 2014 which received a moderate rating for significance (Section C.7.8.1).

The functional significance of the groundwater recharge function for all wetlands was rated moderate based on questions in Form A. The actual recharge on the project site probably rates lower than this, based on geohydrological information collected during the course of field and laboratory studies (Section 3.4.3). The validity of the FHWA procedure for this function evaluation is considered low for basins in non-glaciated regions such as Florida (Adamus 1983).

The groundwater discharge function rated very low for functional significance and low for effectiveness for all wetlands evaluated (Table C.7-2). The procedure does not rate opportunity with respect to discharge, as discharge cannot be predicted without extensive data collection (Adamus 1983).

C.7.2 Flood Storage

Flood storage evaluation for the 11 wetlands is presented in Table C.7-3. All wetlands had a functional significance of moderate. Effectiveness was rated high for all wetlands, primarily due to their position in the watershed and the typically small sub-watersheds which sheetflow to these areas. However, the evaluation does not consider the actual storage volume of the wetland. For example, Wetland No. 1370 has a total area of 2 acres, with a depth of flooding of approximately 0.5 ft at the deepest point (Section 4.0). Above-ground storage capacity is estimated to be less than 1 acre-ft in the wetland. However, the wetland was rated high in terms of effectiveness, opportunity, and functional attributes of storage. The evaluation also does not consider the percentage of the total watershed that the wetland comprises. Thus, the procedure overrates the flood storage potential.

Wetlands with an outlet received a moderate rating for opportunity for flood storage capacity, because the outlet allows storm and floodwaters to pass downstream. Isolated wetlands received a high rating for opportunity due to their ability to retain waters (even though of limited volume) within the wetland.

C.7.3 Shoreline Anchoring

The effectiveness of this function is evaluated by the FHWA procedure on the basis of vegetation type, vegetation density, and wetland width. These are believed to be the important factors in the majority of situations for determining whether the wetland will dissipate erosive forces such as waves and currents. All wetlands evaluated were rated high in effectiveness, but low in the opportunity to provide this function (Table C.7-4) because of the lack of open water areas adjacent to

Table C.7-3. Results of Flood Storage Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	High	High	Low	Moderate
2696	High	High	High	Low	Moderate
2014	High	Moderate	High	Low	Moderate
1370	High	High	High	Low	Moderate
1227	High	High	High	Low	Moderate
1378	High	Moderate	High	Low	Moderate
1690	High	High	High	Low	Moderate
1175	High	High	High	Low	Moderate
2275	High	High	High	Low	Moderate
2139	High	High	High	Low	Moderate
2550	High	Moderate	High	Low	Moderate

Table C.7-4. Results of Shoreline Anchoring Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	Low	Moderate	Low	Moderate
2696	High	Low	Moderate	Low	Moderate
2014	High	Low	Moderate	Low	Moderate
1370	High	Low	Moderate	Low	Moderate
1227	High	Low	Moderate	Low	Moderate
1378	High	Low	Moderate	Low	Moderate
1690	High	Low	Moderate	Low	Moderate
1175	High	Low	Moderate	Low	Moderate
2275	High	Low	Moderate	Low	Moderate
2139	High	Low	Moderate	Low	Moderate
2550	High	Low	Moderate	Low	Moderate

the wetlands. As a result, the functional significance was rated moderate for all wetlands evaluated.

C.7.4 Sediment Trapping

Sediment trapping effectiveness is based on the wetland's ability to retain or "trap" appreciable amounts of sediment from incoming surface water and/or runoff. Those wetlands which are isolated and/or have sheetflow connections had high effectiveness ratings for this function, while wetlands with an outlet received a moderate rating (Table C.7-5). The opportunity for this function was rated as moderate, as there is some probability that sediment will be carried by surface flow or runoff from agricultural/silvicultural activities. The overall functional significance of sediment trapping was rated as moderate for all wetlands evaluated (Table C.7-5) because of the integration methodology used in the FHWA procedure (Section C.6).

C.7.5 Long-Term and Seasonal Nutrient Retention

The evaluation for this function is based on the wetland's ability to be more efficient than non-wetland areas in removing nutrients over long periods and in retaining nutrients temporarily during seasons of nuisance algal blooms. The FHWA procedure assumes that hydroperiod, sediment-trapping effectiveness (Section C.7.4), vegetation type, wetland substrate, and velocity of surface flow or runoff are the most important characteristics in determining the effectiveness of this function (Adamus 1983).

The evaluation results considering long-term and seasonal nutrient removal and retention were variable in terms of effectiveness, opportunity, and functional ratings (Tables C.7-6 and C.7-7). The functional significance of these two components was moderate for all wetlands (Table C.7-7).

C.7.6 Food Chain Support

Food chain support is evaluated in terms of contribution to downstream areas as well as within-wetland or basin cycling and support. The evaluation "keys" of the FHWA method assume that primary productivity, contiguity, flushing or mixing capacity, and decomposition are important in determining the values of these functions. However, due to the complexity of this function, the author of the FHWA method indicates that the results may be the least reliable of the evaluation keys (Adamus 1983).

All wetlands without an outlet were rated low in effectiveness and opportunity and very low in functional significance of the downstream food chain support function (Table C.7-8). Those wetlands with an outlet were rated moderate for effectiveness/opportunity and functional significance. All wetlands evaluated received the same ratings for in-basin food chain support (Table C.7-9). Ratings for effectiveness/opportunity as well as functional significance were moderate.

Table C.7-5. Results of Sediment Trapping Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	Moderate	High	Low	Moderate
2696	High	Moderate	High	Low	Moderate
2014	Moderate	Moderate	Moderate	Low	Moderate
1370	High	Moderate	High	Low	Moderate
1227	High	Moderate	High	Low	Moderate
1378	Moderate	Moderate	Moderate	Low	Moderate
1690	High	Moderate	High	Low	Moderate
1175	High	Moderate	High	Low	Moderate
2275	High	Moderate	High	Low	Moderate
2139	High	Moderate	High	Low	Moderate
2550	Moderate	Moderate	Moderate	Low	Moderate

Table C.7-6. Results of Long-Term Nutrient Retention Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	High	High	Low	Moderate
2696	High	Moderate	High	Low	Moderate
2014	Moderate	Moderate	Moderate	Low	Moderate
1370	High	Moderate	High	Low	Moderate
1227	High	Moderate	High	Low	Moderate
1378	Moderate	Moderate	Moderate	Low	Moderate
1690	High	High	High	Low	Moderate
1175	High	Moderate	High	Low	Moderate
2275	High	High	High	Low	Moderate
2139	High	Moderate	High	Low	Moderate
2550	Moderate	Moderate	Moderate	Low	Moderate

Table C.7-7. Results of Seasonal Nutrient Retention Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness	Opportunity	Functional Rating	Significance	Functional Significance
2734	High	High	High	Low	Moderate
2696	High	Moderate	High	Low	Moderate
2014	Moderate	Moderate	Moderate	Low	Moderate
1370	Moderate	Moderate	Moderate	Low	Moderate
1227	Moderate	Moderate	Moderate	Low	Moderate
1378	Moderate	Moderate	Moderate	Low	Moderate
1690	High	High	High	Low	Moderate
1175	High	Moderate	High	Low	Moderate
2275	High	High	High	Low	Moderate
2139	Moderate	Moderate	Moderate	Low	Moderate
2550	Moderate	Moderate	Moderate	Low	Moderate

Table C.7-8. Results of Downstream Basin Food Chain Support Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness/Opportunity	Functional Rating	Significance	Functional Significance
2734	Low	Low	Low	Very low
2696	Low	Low	Low	Very low
2014	Moderate	Moderate	Low	Moderate
1370	Low	Low	Low	Very low
1227	Low	Low	Low	Very low
1378	Moderate	Moderate	Low	Moderate
1690	Low	Low	Low	Very low
1175	Low	Low	Low	Very low
2275	Low	Low	Low	Very low
2139	Low	Low	Low	Very low
2550	Moderate	Moderate	Low	Moderate

Table C.7-9. Results of In-Basin Food Chain Support Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness/Opportunity	Functional Rating	Significance	Functional Significance
2734	Moderate	Moderate	Low	Moderate
2696	Moderate	Moderate	Low	Moderate
2014	Moderate	Moderate	Low	Moderate
1370	Moderate	Moderate	Low	Moderate
1227	Moderate	Moderate	Low	Moderate
1378	Moderate	Moderate	Low	Moderate
1690	Moderate	Moderate	Low	Moderate
1175	Moderate	Moderate	Low	Moderate
2275	Moderate	Moderate	Low	Moderate
2139	Moderate	Moderate	Low	Moderate
2550	Moderate	Moderate	Low	Moderate

C.7.7 Fishery Habitat

Fishery habitat may be evaluated for:

- cold water species;
- cold water riverine species;
- cold water riverine anadromous species; and
- warm water species.

Selected species which are dependent on wetlands throughout nearly all of their range may also be evaluated. For the project site, warm water species were evaluated.

The evaluation "key" is based on the assumption that factors such as wetland system and subsystem, stream order, substrate, depth, velocity, cover, and salinity as well as measurements of total suspended solids and dissolved solids can be used as predictors for fishery habitat value. However, the "keys" are expected to be least reliable for lacustrine, southern, and warm water species. All wetlands evaluated were rated low in effectiveness/opportunity and very low for functional significance (Table C.7-10). This is reasonable given the lack of permanent waterbodies within the wetlands.

C.7.8 Wildlife Habitat

Wildlife habitat was evaluated with the FHWA procedure for general wildlife diversity and selected harvested waterfowl.

C.7.8.1 General Wildlife Diversity

The general wildlife diversity "key" of the FHWA procedure estimates the annual total number of wetland dependent species. The evaluation considers only diversity, not dependence. All wetlands evaluated, except Wetland No. 2014, were rated low for effectiveness/opportunity and very low for functional significance (Table C.7-11), due to their relatively low diversity of plant forms, low edge-to-area ratio, and low diversity of adjacent land cover types. Wetland No. 2014 was rated moderate for effectiveness/opportunity, functional rating, significance, and functional significance due primarily to its large size and plant form diversity, edge-to-area ratio, and diversity of adjacent land cover types.

C.7.8.2 Harvested Waterfowl

This function is evaluated in terms of the wetland area being able to provide habitat for migrating/wintering and nesting/summering waterfowl. Evaluation "keys" for both these components are provided for nine groups of harvested waterfowl:

1) dabbling ducks that prefer grassland types
2) forest nesting dabbling ducks
3) largely carnivorous ducks
4) forest nesting diving ducks
5) prairie nesting divers with mostly vegetable diet

Table C.7-10. Results of Fishery Habitat Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness/Opportunity	Functional Rating	Significance	Functional Significance
2734	Low	Low	Low	Very low
2696	Low	Low	Low	Very low
2014	Low	Low	Low	Very low
1370	Low	Low	Low	Very low
1227	Low	Low	Low	Very low
1378	Low	Low	Low	Very low
1690	Low	Low	Low	Very low
1175	Low	Low	Low	Very low
2275	Low	Low	Low	Very low
2139	Low	Low	Low	Very low
2550	Low	Low	Low	Very low

Table C.7-11. Results of General Wildlife Diversity Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness/Opportunity	Functional Rating	Significance	Functional Significance
2734	Low	Low	Low	Very low
2696	Low	Low	Low	Very low
2014	Moderate	Moderate	Moderate	Moderate
1370	Low	Low	Low	Very low
1227	Low	Low	Low	Very low
1378	Low	Low	Low	Very low
1690	Low	Low	Low	Very low
1175	Low	Low	Low	Very low
2275	Low	Low	Low	Very low
2139	Low	Low	Low	Very low
2550	Low	Low	Low	Very low

6) prairie nesting divers with mostly invertebrate diet
7) inland swans and geese
8) coastal geese
9) whistling ducks

For evaluation of the selected wetlands, the following groups and habitats were chosen:

Group	Habitat
1	Migrating/wintering
2	Nesting/summering
2	Migrating/wintering
3	Migrating/wintering
4	Migrating/wintering

The majority of wetlands evaluated rated low in all categories and very low in functional significance (Table C.7-12). This was due largely to the lack of permanent open water within the wetland areas and preferred ("high value") food resources.

C.7.9 Active Recreation

The FHWA procedure evaluates this function in terms of the wetland providing for one of the following activities: swimming, boat launching, power boating, canoeing, and sailing. All wetlands evaluated received a rating of low for effectiveness/opportunity, functional rating, and significance, and a rating of very low for functional significance (Table C.7-13), due to the lack of significant open water areas associated with the wetlands.

C.7.10 Passive Recreation and Heritage

Only significance and functional significance are rated for this function in the FHWA method (Adamus 1983). All wetlands evaluated rated low for significance and functional significance due to the lack of any significant archaeological sites and lack of extensive use for passive recreational activities (Table C.7-14).

C.8 FHWA Evaluation Summary

The FHWA procedure does not provide a mechanism for estimating an overall value or score for an evaluated wetland. Because the scores for the wetland functions are not additive, no summary evaluation scores are provided. Generally, all evaluated wetlands rated similar for each functional rating and significance. However, differences between wetlands for a particular function were related to wetland size, contiguity, hydrologic connection, and diversity of plant forms.

Table C.7-12. Results of Selected Harvested Waterfowl Habitat Evaluation Using the FHWA Method.

Wetland No.	Group (Habitat)*	Effectiveness/ Opportunity	Functional Rating	Significance	Functional Significance
2734	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
2696	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
2014	1 (M/W)	Moderate	Moderate	Low	Moderate
	2 (N/S)	Moderate	Moderate	Low	Moderate
	2 (M/W)	Moderate	Moderate	Low	Moderate
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
1370	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
1227	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low

Table C.7-12 (Continued).

Wetland No.	Group (Habitat)*	Effectiveness/ Opportunity	Functional Rating	Significance	Functional Significance
1378	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
1690	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Moderate	Moderate	Low	Moderate
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
1175	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Moderate	Moderate	Low	Moderate
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
2275	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low
2139	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low

Table C.7-12 (Continued).

Wetland No.	Group (Habitat)*	Effectiveness/ Opportunity	Functional Rating	Significance	Functional Significance
2550	1 (M/W)	Low	Low	Low	Very low
	2 (N/S)	Low	Low	Low	Very low
	2 (M/W)	Low	Low	Low	Very low
	3 (M/W)	Low	Low	Low	Very low
	4 (M/W)	Low	Low	Low	Very low

*M/W = Migrating/Wintering habitat.
N/S = Nesting/Summering habitat.

Table C.7-13. Results of Active Recreation Function Evaluation Using the FHWA Method.

Wetland No.	Effectiveness/Opportunity	Functional Rating	Significance	Functional Significance
2734	Low	Low	Low	Very low
2696	Low	Low	Low	Very low
2014	Low	Low	Low	Very low
1370	Low	Low	Low	Very low
1227	Low	Low	Low	Very low
1378	Low	Low	Low	Very low
1690	Low	Low	Low	Very low
1175	Low	Low	Low	Very low
2275	Low	Low	Low	Very low
2139	Low	Low	Low	Very low
2550	Low	Low	Low	Very low

Table C.7-14. Results of Passive Recreation and Heritage Value Function Evaluation Using the FHWA Method.

Wetland No.	Significance	Functional Significance
2734	Low	Low
2696	Low	Low
2014	Low	Low
1370	Low	Low
1227	Low	Low
1378	Low	Low
1690	Low	Low
1175	Low	Low
2275	Low	Low
2139	Low	Low
2550	Low	Low

C.9 Comparison of Existing Wetland Functional Values to Reclaimed System Values

Values of wetland functions for reclaimed systems were assessed based on the WEP and FHWA procedures. Reclaimed systems were considered to be post-reclamation plus 30 years. The following sections provide the results of the evaluations using both the WEP and FHWA methods.

C.9.1 WEP Method

Functional attributes of the seven existing wetland types were compared to functional attributes of post-reclamation (over 30 years) wetland systems created on land and lakes, elevated fill, and tailings fill (Table C.9-1). Evaluations were made using the Wetlands Evaluation Procedure of Reppert et al. (1979), as modified by the Jacksonville District ACOE. Existing values were calculated using scores from either wetland 2014, 1378, or 2550 and adjusting for acreages and/or specific vegetation type. No wetland reclamation demonstration projects exist that are 30 or more years in age, so values generated for reclaimed systems were projected based on known reclamation techniques, physical characteristics of these reclamation types, and the premise that vegetation species characteristic of these wetland systems can be established on the substrates available after the earth-moving and contouring phase of reclamation is completed.

Overall, the reclaimed and naturally occurring systems generally had similar values for the functional criteria. In all cases, wetlands created as part of land and lakes systems are projected to score numerically higher than existing wetlands. Many of the reclaimed wetland systems created on elevated fill and tailings fill, particularly those with some degree of contiguity with downstream systems, are projected to score similar to the existing conditions. The basis for the higher projected numerical scores for these reclaimed wetland systems as compared to existing conditions is primarily due to the increased degree of contiguity of reclaimed wetlands with downstream systems.

C.9.2 FHWA Method

Functional attributes of post-reclamation (+30 years) wetland systems created on land and lakes, elevated fill, and tailings fill were evaluated with the FHWA method (Adamus 1983). Only Form A questions of the procedure were used, as Form B requires extensive knowledge of the social and surrounding land use characteristics which are difficult to predict for the time period of evaluation. Utilizing Form A, effectiveness, opportunity, and functional rating of the various wetland functions can be evaluated (Section C.6). Evaluation of passive recreation and heritage requires the use of Form B; thus, this function was not evaluated for the post-reclamation wetland systems. Results of the FHWA evaluation for reclaimed systems are presented in Tables C.9-2 through C.9-4.

The results are variable for most functions, depending on wetland type, reclaimed land form, and contiguity. Results of the Adamus (1983) evaluation indicate a general increase in shoreline anchoring, downstream food chain support, general wildlife diversity, and active recreation for reclaimed systems, but a decrease in groundwater recharge, based on

Table C.9-1. Comparison of Existing Wetland Functional Values to Projected Values for Reclaimed Systems Using the WEP Method (Reppert et al. 1979).

Wetland Type	Function	Existing Score	Land and Lakes		Elevated Fill		Tailings Fill	
			Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score
Cypress -- 6110 (200 acres)	Food chain production	2.33	2.00	2.00	1.67	1.33	1.67	1.33
	General and specialized habitat	3.50	3.00	3.00	3.00	2.00	3.00	2.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	3.00	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	2.75	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	2.33	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	34.91	37.08	37.08	33.42	29.58	33.42	29.58
Swamp tupelo -- 6211 (200 acres)	Food chain production	2.00	2.00	2.00	1.67	1.33	1.67	1.33
	General and specialized habitat	3.00	3.00	3.00	3.00	2.00	3.00	2.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	2.50	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	2.50	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	1.67	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	31.67	37.08	37.08	33.42	29.58	33.42	29.58
Bayhead -- 6212 (200 acres)	Food chain production	2.00	2.33	2.00	1.67	1.33	1.67	1.33
	General and specialized habitat	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	2.50	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	2.50	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	1.67	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	31.67	37.41	37.08	33.42	30.58	33.42	30.58

Table C.9-1 (continued).

Wetland Type	Function	Existing Score	Land and Lakes		Elevated Fill		Tailings Fill	
			Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score
Scrub/shrub -- 6213 (200 acres)	Food chain production	2.33	2.33	1.67	1.33	1.00	1.33	1.00
	General and specialized habitat	3.50	3.00	3.00	2.00	2.00	2.00	2.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	3.00	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	2.50	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	2.00	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	31.33	37.41	36.75	32.08	29.25	32.08	29.25
Cypress/ Swamp Tupelo/ Bay -- 6311 (200 acres)	Food chain production	1.67	2.00	2.00	1.67	1.33	1.67	1.33
	General and specialized habitat	3.50	3.00	3.00	3.00	2.00	3.00	2.00
	Hydrologic periodicity	1.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	1.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	2.50	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	2.50	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	2.33	2.33	2.00	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	32.50	37.08	36.75	33.42	29.58	33.42	29.58
Swamp Tupelo/ Bay/Pine -- 6312 (200 acres)	Food chain production	2.33	2.33	2.33	2.00	1.67	2.00	1.67
	General and specialized habitat	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	3.00	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	3.00	2.75	2.75	2.75	2.75	2.75	2.75
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	2.00	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.50	3.00	3.00	2.50	2.50	2.50	2.50
	TOTAL SCORE	31.33	36.41	36.41	32.75	29.92	32.75	29.92

Table C.9-1 (continued).

Wetland Type	Function	Existing Score	Land and Lakes		Elevated Fill		Tailings Fill	
			Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score	Open Drainage Score	Isolated Score
Emergent marsh -- 6410 (200 acres)	Food chain production	3.00	2.67	2.33	2.00	1.67	2.00	1.67
	General and specialized habitat	3.00	2.00	2.00	2.00	2.00	2.00	2.00
	Hydrologic periodicity	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Location or elevation within wetland system	2.00	3.00	3.00	2.00	1.00	2.00	1.00
	Flood storage	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Flood retardation	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	Natural groundwater recharge	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Wetland type	3.00	3.50	3.50	3.00	2.50	3.00	2.50
	Areal and waste-loading relationships	3.25	3.25	3.25	3.25	3.25	3.25	3.25
	Geographic and other locational factors	2.50	3.50	3.50	3.50	3.50	3.50	3.50
	Socioeconomic benefits and renewable resources	1.00	2.00	2.00	2.00	2.00	2.00	2.00
	Culturally perceived values	2.00	2.33	2.33	2.00	2.00	2.00	2.00
	Habitat for rare, restricted, and relic flora and fauna	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	Shoreline protection	2.38	2.88	2.88	2.38	2.38	2.38	2.38
	TOTAL SCORE	32.13	37.13	36.79	33.13	30.30	33.13	30.30

Score	Ranking
14-27	Low (L)
28-42	Moderate (M)
42-56	High (H)

NOTE: Rankings are only for comparison with those obtained using the Adamus (1983) procedure. No Very Low (VL) or Very High (VH) ratings were applicable, as Form 8 of the Adamus procedure could not be completed for reclaimed systems.

Table C.9-2. Effectiveness Ratings for Wetland Functions of Reclaimed Systems (Post-Reclamation + 30 Years) Using the FHWA Method.[1]

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C
Groundwater recharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Shoreline anchoring	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Sediment trapping	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Long-term nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Seasonal nutrient retention	M	M	M	M	L	L	M	M	M	M	M	M	M	M
Downstream food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	L	L
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	M	M	M	M	L	L
Group 4 (M/W)	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Active recreation	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-2 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C
Groundwater recharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	H	H	H	H	M	H	H	H	M	H	M	H	M	H
Shoreline anchoring	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Sediment trapping	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Long-term nutrient retention	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Seasonal nutrient retention	M	M	M	M	L	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	L	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-2 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C
Groundwater recharge	L	M	L	M	L	M	L	M	L	M	L	M	L	M
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	H	H	H	H	H	H	H	H	H	H	H	H	M	H
Shoreline anchoring	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Sediment trapping	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Long-term nutrient retention	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Seasonal nutrient retention	M	M	M	M	L	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	L	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1]Adamus 1983
- H high
- M moderate
- L low
- N/A function not rated

[2]
- 6110 Cypress
- 6211 Swamp tupelo
- 6212 Bayhead
- 6213 Scrub/shrub
- 6311 Cypress/swamp tupelo/bay
- 6312 Swamp tupelo/bay/pine
- 6410 Emergent marsh

- LL-O Land and lakes - open drainage
- LL-C Land and lakes - closed drainage
- EL-O Elevated fill - open drainage
- EL-C Elevated fill - closed drainage
- TF-O Tailings fill - open drainage
- TF-C Tailings fill - closed drainage

[3]
- M/W Migrating/wintering habitat
- N/S Nesting/summering habitat

Table C.9-3. Opportunity Ratings for Wetland Functions of Reclaimed Systems (Post-Reclamation + 30 Years) Using the FHWA Method.[1]

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C
Groundwater recharge	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Groundwater discharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flood storage	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Shoreline anchoring	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Sediment trapping	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Long-term nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Seasonal nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	L	L
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	M	M	M	M	L	L
Group 4 (M/W)	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Active recreation	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-3 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C
Groundwater recharge	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Groundwater discharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flood storage	M	M	H	M	M	M	M	M	M	M	M	M	M	M
Shoreline anchoring	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Sediment trapping	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Long-term nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Seasonal nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	M	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	L	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	M	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-3 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C
Groundwater recharge	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Groundwater discharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flood storage	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Shoreline anchoring	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Sediment trapping	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Long-term nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Seasonal nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	L	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1]Adamus 1983
- H high
- M moderate
- L low
- N/A function not rated

[2]
- 6110 Cypress
- 6211 Swamp tupelo
- 6212 Bayhead
- 6213 Scrub/shrub
- 6311 Cypress/swamp tupelo/bay
- 6312 Swamp tupelo/bay/pine
- 6410 Emergent marsh
- LL-O Land and lakes - open drainage
- LL-C Land and lakes - closed drainage
- EL-O Elevated fill - open drainage
- EL-C Elevated fill - closed drainage
- TF-O Tailings fill - open drainage
- TF-C Tailings fill - closed drainage

[3]
- M/W Migrating/wintering habitat
- N/S Nesting/summering habitat

Table C.9-4. Functional Ratings for Wetland Functions of Reclaimed Systems (Post-Reclamation + 30 Years) Using the FHWA Method.[1]

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C	LL-O	LL-C
Groundwater recharge	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Shoreline anchoring	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Sediment trapping	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Long-term nutrient retention	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Seasonal nutrient retention	M	M	M	M	L	L	M	M	M	M	M	M	M	M
Downstream food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	L	L
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	M	M	M	M	L	L
Group 4 (M/W)	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Active recreation	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-4 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C	EL-O	EL-C
Groundwater recharge	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	H	H	H	H	M	H	H	H	M	H	M	H	M	H
Shoreline anchoring	H	H	H	H	H	H	H	H	M	H	H	H	H	H
Sediment trapping	H	H	M	H	M	H	M	H	M	H	M	H	M	H
Long-term nutrient retention	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Seasonal nutrient retention	M	M	M	M	L	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	L	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.9-4 (Continued).

Function[2]	Wetland Type and Reclaimed Land Form													
	6110		6211		6212		6213		6311		6312		6410	
	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C	TF-O	TF-C
Groundwater recharge	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Groundwater discharge	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Flood storage	H	H	H	H	H	H	H	H	H	H	H	H	M	H
Shoreline anchoring	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Sediment trapping	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Long-term nutrient retention	M	H	M	H	M	H	M	H	M	H	M	H	M	H
Seasonal nutrient retention	M	M	M	M	L	M	M	M	M	M	M	M	M	M
Downstream food chain support	M	L	M	L	M	L	M	L	M	L	M	L	M	L
In-basin food chain support	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Fishery habitat	L	L	L	L	L	L	L	L	L	L	L	L	L	L
General wildlife diversity	L	L	L	L	L	L	M	M	M	M	M	M	M	M
Harvested waterfowl[3]														
Group 1 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (N/S)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 2 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 3 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Group 4 (M/W)	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Active recreation	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Passive recreation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1]Adamus 1983
- H high
- M moderate
- L low
- N/A function not rated

[2]
- 6110 Cypress
- 6211 Swamp tupelo
- 6212 Bayhead
- 6213 Scrub/shrub
- 6311 Cypress/swamp tupelo/bay
- 6312 Swamp tupelo/bay/pine
- 6410 Emergent marsh

- LL-O Land and lakes - open drainage
- LL-C Land and lakes - closed drainage
- EL-O Elevated fill - open drainage
- EL-C Elevated fill - closed drainage
- TF-O Tailings fill - open drainage
- TF-C Tailings fill - closed drainage

[3]
- M/W Migrating/wintering habitat
- N/S Nesting/summering habitat

geohydrological data. However, the validity of the FHWA procedure for evaluating groundwater recharge may be low, particularly in non-glaciated areas such as the project site (Adamus 1983).

Evaluation results also indicated that flood storage, sediment trapping, and long-term and seasonal nutrient retention values decrease in reclaimed systems. These results may be rated incorrectly when considering the actual increased flood storage effectiveness of the reclaimed lakes. Those areas would also provide increased sediment trapping and nutrient retention capabilities, compared to existing systems.

Groundwater discharge, in-basin food chain support, and fishery habitat value are relatively unchanged in reclaimed systems compared to existing systems. However, these results may be misleading, particularly in the land and lakes reclamation type where wetlands associated with lakes would offer nursery areas and the necessary structure for maintenance of viable fish populations.

C.9.3 Wetland Functional Unit Analysis

Mined and reclaimed wetland functional units were evaluated using scores of the WEP method. WEP scores of existing systems and the median WEP score of reclaimed systems (see Table C.9-1) were multiplied by acres of various wetland types mined and reclamation types to determine the functional units for mined versus reclaimed wetlands under each alternative. The results of this analysis are presented in Table C.9-5.

C.10 Literature Cited

Adamus, P.R. 1983. A method for wetland functional assessment. Federal Highway Administration, U.S. Dept. of Transportation, Washington, DC. 2 vols. Report Nos. FHWA-IP-82-23 and FHWA-IP-82-24.

Anderson, B.W., R.D. Ohmart, and J. Disano. 1978. Revegetating the riparian floodplain for wildlife. Pages 318-331 in Johnson, R.R. and J.F. McCormick (tech. coord.), Strategies for protection and management of floodplain wetlands and other riparian ecosystems. U.S. Forest Service Gen. Tech. Rep. WO-12.

Brinson, M.M., B.L. Swift, R.C. Plantico, and J.S. Barclay. 1981. Riparian ecosystems: their ecology and status. Eastern Energy and Land Use Team, National Water Resources Analysis Group, U.S. Fish and Wildlife Service, Kearneysville, WV. FWS/OBS-81/17.

Brown, M.T., S. Brown, R. Costanza, E. DeBellevue, K.C. Ewel, R. Gutierrez, D. Layland, W. Mitsch, and M. Sell. 1975. Natural systems and carrying capacity of the Green Swamp. Report to Florida Division of State Planning. Center for Wetlands, Univ. of Florida, Gainesville.

Brown, S. 1978. A comparison of cypress ecosystems in the landscape of Florida. Ph.D. dissertation, Univ. of Florida, Gainesville.

Table C.9-5. Schedule of Wetland Acres[1] to be Disturbed and Reclaimed for the Proposed Mining Alternatives.

Cover Type	WEP Score	Alternative A							
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 25	Yr 30	Total	WFU[5]
DISTURBED									
Cypress (6110)	34.91	0	0	0	0	0	0	0	0
Swamp tupelo (6211)	31.67	0	0	0	0	0	0	0	0
Bayhead (6212)	31.67	0	0	0	0	0	0	0	0
Scrub/shrub (6213)	31.33	0	0	0	0	0	0	0	0
Cypress/swamp tupelo/bay (6311)	32.50	0	0	0	0	0	0	0	0
Swamp tupelo/bay/pine (6312)	31.33	0	0	0	0	0	0	0	0
Emergent (6410)	32.13	0	0	0	0	0	0	0	0
Total		0	0	0	0	0	0	0	0
Cumulative summary		0	0	0	0	0	0	0	-
RECLAIMED									
Land and lakes[2]	36.91	436	643	253	0	0	0	1332	49,164
Elevated fill[3]	31.34	26	131	582	0	0	0	739	23,160
Tailings fill[3]	31.34	0	0	0	0	0	0	0	0
Total		462	774	835	0	0	0	2071	72,324
Cumulative summary[4]		462	1236	2071	2071	2071	2071	2071	-

Table C.9-5 (Continued).

Cover Type	WEP Score	Alternative B							
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 25	Yr 30	Total	WFU[5]
DISTURBED									
Cypress (6110)	34.91	17	77	53	125	220	0	492	17,176
Swamp tupelo (6211)	31.67	27	42	98	4	79	1	251	7,949
Bayhead (6212)	31.67	0	244	74	1	57	0	376	11,908
Scrub/shrub (6213)	31.33	0	50	64	117	0	0	231	7,237
Cypress/swamp tupelo/bay (6311)	32.50	675	1,065	1,372	949	429	21	4,511	146,608
Swamp tupelo/bay/pine (6312)	31.33	1,040	1,432	619	182	19	0	3,292	103,138
Emergent (6410)	32.13	10	34	44	14	9	0	111	3,566
Total		1,769	2,944	2,324	1,392	813	22	9,264	297,582
Cumulative summary		1,769	4,713	7,037	8,429	9,242	9,264	9,264	-
RECLAIMED									
Land and lakes[2]	36.91	240	395	497	427	620	255	2,434	89,839
Elevated fill[3]	31.34	119	331	1,122	1,029	2,812	1,174	6,587	206,437
Tailings fill[3]	31.34	0	343	820	705	213	233	2,314	75,521
Total		359	1,069	2,439	2,161	3,645	1,662	11,335	371,797
Cumulative summary[4]		359	1,428	3,867	6,028	9,673	11,335	11,335	-

Table C.9-5 (Continued).

Cover Type	WEP Score	Alternative C							
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 25	Yr 30	Total	WFU[5]
DISTURBED									
Cypress (6110)	34.91	0	1	1	181	0	0	183	6,389
Swamp tupelo (6211)	31.67	0	39	6	19	0	0	64	2,027
Bayhead (6212)	31.67	0	0	0	0	0	0	0	0
Scrub/shrub (6213)	31.33	0	2	10	0	0	0	12	376
Cypress/swamp tupelo/bay (6311)	32.50	634	473	527	196	0	0	1,830	9,475
Swamp tupelo/bay/pine (6312)	31.33	193	73	72	0	0	0	338	10,590
Emergent (6410)	32.13	1	10	14	0	0	0	25	803
Total		828	598	630	396	0	0	2,452	29,660
Cumulative summary		828	1,426	2,056	2,452	2 ,452	2452	2,452	-
RECLAIMED									
Land and lakes[2]	36.91	280	408	671	457	82	0	1,898	70,055
Elevated fill[3]	31.34	70	230	732	1,224	369	0	2,625	82,268
Tailings fill[3]	31.34	0	0	0	0	0	0	0	0
Total		350	638	1,403	1,681	451	0	4,523	152,323
Cumulative summary[4]		350	988	2,391	4,072	4,523	4,523	4,523	-

Table C.9-5 (Continued).

Cover Type	WEP Score	Alternative D							
		Yr 5	Yr 10	Yr 15	Yr 20	Yr 25	Yr 30	Total	WFU[5]
DISTURBED									
Cypress (6110)	34.91	0	69	181	52	219	0	521	18,188
Swamp tupelo (6211)	31.67	0	29	146	144	0	0	319	10,103
Bayhead (6212)	31.67	24	25	245	138	2	0	434	13,745
Scrub/shrub (6213)	31.33	16	8	109	156	24	0	313	9,806
Cypress/swamp tupelo/bay (6311)	32.50	663	1080	1,175	837	477	0	4,232	137,540
Swamp tupelo/bay/pine (6312)	31.33	933	772	225	551	140	0	2,621	82,116
Emergent (6410)	32.13	8	5	19	121	8	0	161	5,173
Total		1,644	1,988	2,100	1,999	870	0	8,601	276,671
Cumulative summary		1,644	3,632	5,732	7,731	8,601	8,601	8,601	-
RECLAIMED									
Land and lakes[2]	36.91	252	323	472	500	382	226	2,155	79,541
Elevated fill[3]	31.34	118	353	1,327	547	3,102	850	6,297	197,348
Tailings fill[3]	31.34	0	416	629	818	318	39	2,220	69,575
Total		370	1,092	2,428	1,865	3,802	1,115	10,672	346,464
Cumulative summary[4]		370	1,462	3,890	5,755	9,557	10,672	10,672	-

[1]Includes both mandatory and nonmandatory reclamation lands and assumes that nonmandatory lands will be reclaimed under Chapter 378, FS, and Chapter 16C-17, FAC.
[2]Wetlands portion (zone of fluctuation) of land and lakes reclamation type; includes approximately 117 acres of wetlands created in previous land and lakes reclamation.
[3]Wetlands portion of reclamation type.
[4]Includes acre-for-acre replacement of wetlands mined since 1975 and prior to January 1982.
[5]WFU = wetland functional unit = (WEP Score) x (Number of Acres).

Brown, S. 1981. A comparison of the structure, primary productivity, and transpiration of cypress ecosystems in Florida. Ecol. Monog. 51 (4):403-427.

Byrd, A. and L. Halbrook. 1974. How to improve forest game habitat. USDA Forest Service, Forest Management Bulletin, Atlanta, GA.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31. 103 pp.

Florida Department of Administration. 1976. The Florida land use and cover classification system: a technical report. Div. of State Planning, Bur. of Comprehensive Planning, Tallahassee. 50 pp.

Gasaway, R.D. 1973. Study of fish movements from tributary streams into the Suwannee River. Ann. Progress Rep., Statewide Fisheries Investigation F-21-5, Study VI, Job 2, Georgia Game and Fish Comm., Dept. of Nat. Res., Atlanta.

Glasgow, L.L. and R.E. Noble. 1971. The importance of bottomland hardwoods to wildlife. Pages 30-43 in Proceedings of the First Symposium on Southeastern hardwoods. U.S. Forest Service, Atlanta, GA.

Golet, F.C. 1973. Wetlands and wildlife. Pages 12-14 in Larson, J.S. (ed.), A guide to important characteristics and values of freshwater wetlands in the Northeast. Water Resources Research Center, Univ. of Massachusetts, Amherst. Publ. No. 31. 35 pp.

Hall, C.A.S. 1972. Migration and metabolism in a temperate stream ecosystem. Ecology 53:585-604.

Hirsch, A. and C.A. Segelquist. 1978. Position paper: protection and management of riparian ecosystems: activities and views of the U.S. Fish and Wildlife Service. Pages 344-352 in Johnson, R.R. and J.F. McCormick (tech. coord.), Strategies for protection and management of floodplain wetlands and other riparian ecosystems. USDA Forest Service Gen. Tech. Rep. WO-12.

Larson, J.S. (ed.). 1973. A guide to important characteristics and values of freshwater wetlands in the Northeast. Water Resources Research Center, Univ. of Massachusetts, Amherst. Publ. No. 31. 43 pp.

Larson, J.S. (ed.). 1976. Models for evaluation of freshwater wetlands. Water Resources Research Center, Univ. of Massachusetts, Amherst. Publ. No. 32. 91 pp.

Leopold, A. 1932. Game management. Charles Scribner's Sons, New York. 481 pp.

Lonard, R.I., E.J. Clairain, Jr., R.T. Huffman, J.W. Hardy, L.D. Brown, P.E. Ballard, and J.W. Watts. 1981. Analysis of methodologies used for the assessment of wetlands values. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Lugo, A.E., J.F. Gamble, and K.C. Ewel. 1978. Organic matter dynamics in a mixed hardwood forest in north central Florida. In Proceedings of the Second Mineral Cycling Symposium.

MacArthur, R.H., J.W. MacArthur, and J. Preer. 1962. On bird species diversity. Part II. Prediction of bird census from measurements. Am. Naturalist 180:319-332.

Mitsch, W.J. and K.C. Ewel. 1979. Comparative biomass and growth of cypress in Florida wetlands. American Midland Naturalist 101(2): 417-426.

Odum, H.T. 1977. Value of wetlands as domestic ecosystems. Presented at Wetlands Conference of the Environmental Law Institute, Reston, VA., May 1977.

Odum, H.T. 1978. Principles for interfacing wetlands with development. Pages 29-56 in Drew, D.A. (ed.), Environmental quality through wetlands utilization. Proceedings from a symposium sponsored by the Coordinating Council on the Restoration of the Kissimmee River Valley and Taylor Creek-Nubbin Slough Basin, Tallahassee, FL.

Reppert, R.T., W. Sigleo, E. Stakhiv, L. Messman, and C. Meyers. 1979. Wetland values, concepts and methods for wetlands evaluation. U.S. Army Corps of Engineers, Institute for Water Resources, Ft. Belvoir, VA. Res. Rept. 79-R1. 109 pp.

U.S. Army Corps of Engineers (ACOE). 1980. A habitat evaluation system for water resources planning. Environmental Analysis Branch, Lower Mississippi Valley Division, Vicksburg, MS. 89 pp. + App.

U.S. Army Engineer Division, New England. 1972. Charles River. Main Report and Attachments. Waltham, MA.

U.S. Department of Agriculture (USDA). 1978. Wetlands evaluation criteria--water and related land resources of the coastal region, Massachusetts. Soil Conservation Service, Washington, DC.

U.S. Fish and Wildlife Service (FWS). 1984. Proceedings of the National Wetland Values Assessment Workshop, 23-26 May 1983, Alexandria, Virginia. FWS Western Energy and Land Use Team, Fort Collins, CO. 100 pp.

U.S. Forest Service (USFS). 1975. Proceedings of the symposium on management of forest and range habitats for non-game birds. USDA Forest Service. Gen. Tech. Rept. VJO-1. 343 pp.

Weller, M.W. 1978. Management of freshwater marshes for wildlife. Pages 267-284 in Good, R.E., D.F. Whigham, and R.L. Simpson (eds.), Freshwater wetlands: ecological processes and management potential. Academic Press, New York.

Winchester, B.H. 1979. Valuation of freshwater wetlands on the Mississippi Chemical Corporation property and in the surrounding region. CH2M Hill, Inc., Gainesville, FL. 43 pp.

Winchester, B.H. and L.D. Harris. 1979. An approach to valuation of Florida freshwater wetlands. In Proceedings of the Sixth Annual Conference on the Restoration and Creation of Wetlands, Tampa, FL.

APPENDIX D

EVALUATION CRITERIA FOR SELECTED SPECIES

TABLE OF CONTENTS

APPENDIX D
EVALUATION CRITERIA FOR SELECTED SPECIES

D.1 Fish

Redfin pickerel (Esox americanus)

Habitat: Small, quiet, heavily vegetated waters like streams, drainage canals, ponds, and bays of small lakes; more often in streams than lakes; prefers clear water and little current.

Food: Immature insects, crayfish and other invertebrates, and fish.

Reproduction: Spawns in spring and fall at water temperatures of 10° C.

Water Quality Tolerance: Prefers acidic habitats and probably tolerant of low dissolved oxygen conditions and high temperatures.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Eastern mud minnow (Umbra pygmaea)

Habitat: Quiet, mud-bottom, often heavily vegetated streams, sloughs, and ponds, particularly along margins.

Food: Immature insects and other small invertebrates.

Reproduction: Spawns in the spring.

Water Quality Tolerance: Generally tolerant of acidic habitats and low dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Pirate perch (Aphredoderus sayanus)

Habitat: Lakes, ponds, swamps, quiet pools, and backwaters of low gradient streams, with abundance of aquatic macrophytes, organic debris, and other cover.

Food: Aquatic insects, small crustaceans, other invertebrates, and occasionally small fish.

Reproduction: Spawns in spring.

Water Quality Tolerance: Generally tolerant of low pH and dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Mud sunfish (Acantharchus pomotis)

Habitat: Darkly stained, sluggish, weedy, lowland streams and lakes with mud or silt substrates.

Food: Aquatic insects and zooplankton.

Reproduction: Spawns in late spring and summer.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Swamp darter (Etheostoma fusiforme)

Habitat: Slow-moving or stagnant waters of ponds, swamps, and sluggish streams over a bottom of mud and detritus.

Food: Crayfish and other aquatic invertebrates.

Reproduction: Spawns primarily in spring.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Golden topminnow (Fundulus chrysotus)

Habitat: Backwaters, pools of ditches, and slow-moving streams; usually associated with heavy submergent vegetation.

Food: Aquatic insects and other invertebrates at or near water surface.

Reproduction: Deposits eggs on plants, stones, and other available substrate.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions; occasionally found in brackish water.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Least killifish (Heterandria formosa)

Habitat: Weedy ponds and stream margins.

Food: Zooplankton, immature insects, snails and other invertebrates, algae, and plant debris.

Reproduction: Not known.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions; also brackish water ≤30 ppt NaCl.

References: Reimer 1970; Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Flagfish (Jordanella floridae)

Habitat: Endemic to peninsular Florida where it is found in shallow, open, heavily vegetated ditches, ponds, and lakes, often of ephemeral nature.

Food: Bottom vegetation.

Reproduction: Eggs can survive severely reduced moisture.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

Banded pygmy sunfish (Elassoma zonatum)

Habitat: Roadside ditches, swamps, and clear quiet waters with thick growth of submergent vegetation.

Food: Small crustaceans, midge larvae and pupae, small molluscs, and other invertebrates.

Reproduction: Scatters eggs over bottom and covers with debris.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions.

References: Clay 1975; Eddy 1969; Lee, et al. 1980; Carlander 1969, 1977; Barney 1920.

Warmouth (Lepomis gulosus)

Habitat: Abundant in weedy ditches having little current and in swamps, sloughs, natural lakes, and borrow pits; prefers clear water and thick growth of submerged vegetation.

Food: Mainly insects, crayfish, and fish.

Reproduction: Constructs nest near cover.

Water Quality Tolerance: Generally tolerant of acidic waters and low dissolved oxygen conditions; tolerant of brackish water ≤4.1 ppt NaCl.

References: Clay 1975; Eddy 1969; Lee et al. 1980; Carlander 1969, 1977.

D.2 Amphibians

Two-toed amphiuma (*Amphiuma means*)

Habitat: Variety of aquatic habitats including ponds, lakes, bogs, cypress domes, swamps, and freshwater marshes.

Food: Primarily crayfish, but will take other aquatic insects.

Reproduction: Eggs laid under logs at water's edge in midsummer.

Reference: Conant 1975.

Greater siren (*Siren lacertina*)

Habitat: All types of aquatic situations including lakes, impoundments, ponds, bogs, and mixed swamps.

Food: Primarily crayfish.

Reproduction: Eggs laid in spring; not much else known.

Reference: Conant 1975.

Eastern lesser siren (*Siren intermedia*)

Habitat: Flatwoods ponds, cypress domes, bayheads, bogs, mixed swamps, and muddy, mucky stream bottoms, generally in soft substrate.

Food: Crayfish and other aquatic invertebrates.

Reproduction: Unknown, other than lays eggs.

Reference: Conant 1975.

Flatwoods salamander (*Ambystoma cingulatum*)

Habitat: Pine flatwoods with wiregrass clumps; cypress domes.

Food: Small invertebrates.

Reproduction: Lays eggs under logs in cypress domes and among wiregrass clumps in pine flatwoods.

Reference: Goin 1958; Telford 1954; Martof 1968.

Southern dusky salamander (*Desmognathus auriculatus*)

Habitat: Mucky river bottoms, swamps, bogs, bayheads, and hydric hammocks.

Food: Small invertebrates.

Reproduction: Eggs laid throughout the year under logs near water's edge.

References: Rossman 1959; Neill 1951.

Pine woods treefrog (Hyla femoralis)

Habitat: Pinelands.

Food: Variety of insects.

Reproduction: Breeds in spring and summer in small ponds, temporary rainwater pools, flooded pastures, and roadside ditches. Tadpole stage is 50-75 days.

References: Conant 1975; Wright and Wright 1932, 1949.

Bullfrog (Rana catesbeiana)

Habitat: Larger permanent bodies of water such as lakes, reservoirs, and pools.

Food: Arthropods, fish, smaller frogs, and snakes.

Reproduction: Breeds in summer; lays eggs in water covered with thick vegetation. Tadpole stage may last ≥1 year.

References: Conant 1975; Wright and Wright 1932, 1949.

River frog (Rana hecksheri)

Habitat: Mixed swamps, cypress domes, and cypress-lined rivers.

Food: Anything it can overpower.

Reproduction: Breeds in cypress ponds in summer. Tadpole period is approximately 2 years.

Reference: Conant 1975; Wright and Wright 1932, 1949.

Pig frog (Rana grylio)

Habitat: Lakes, reservoirs, ponds, larger streams and rivers, cypress ponds, and fresh and saltwater marshes; occurs along edges in streams and rivers.

Food: Primarily crayfish, but will take anything it can overpower.

Reproduction: Eggs laid in warmer months in water with thick vegetation cover. Tadpole stage may last 1-2 years.

References: Conant 1975; Wright and Wright 1932, 1949.

Bronze frog (Rana clamitans)

Habitat: Hammock streams, mixed swamps, cypress swamps, cypress domes, and bayheads.

Food: Snails and arthropods.

Reproduction: Breeds in cypress and bayhead pools in mid-summer. Tadpole stage is approximately 1 year.

Reference: Conant 1975; Wright and Wright 1932, 1949.

D.3 Reptiles

American alligator (*Alligator mississippiensis*)

Habitat: All permanent aquatic habitats.

Food: Anything it can overpower.

Reproduction: Eggs laid in midsummer in large mound nest at water's edge.

References: Neill 1971; Fogarty and Campbell 1978.

Florida mud turtle (*Kinosternon subrubrum*)

Habitat: Shallow, temporary or semi-temporary freshwater areas; most common in cypress domes, although rarely encountered.

Food: Plant and animal material.

Reproduction: Lays eggs in mid-summer in shallow depressions near water's edge.

References: Ernst et al. 1972, 1973, 1974.

Striped mud turtle (*Kinosternon bauri*)

Habitat: Permanent or temporary bodies of water with soft bottoms.

Food: Insects, worms, plant material, fish, and dead animals.

Reproduction: Eggs laid in shallow depressions or under debris.

References: Ernst 1974; Ernst et al. 1972.

Brown water snake (*Nerodia taxispilota*)

Habitat: Rivers, spring runs, and swamps; seldom encountered without cypress trees growing at or in water's edge.

Food: Fish, salamanders, and frogs.

Reproduction: Young born alive in mid to late summer.

Reference: Conant 1975.

Florida banded water snake (*Nerodia fasciata pictiventris*)

Habitat: Permanent or semi-permanent aquatic situations such as lakes, rivers, spring runs, freshwater marshes, bogs, small ponds, and streams.

Food: Frogs, tadpoles, salamanders, and fish.

Reproduction: Young born alive.

References: Conant 1975; Allen 1938.

Eastern glossy water snake (Regina rigida)

Habitat: Bayheads, bogs, and cypress domes.

Food: Crayfish.

Reproduction: Young born alive.

References: Conant 1975; Huheey 1959.

Striped swamp snake (Regina alleni)

Habitat: Lakes, ponds, bayheads, freshwater marshes, cypress domes, and roadside ditches; greatest abundance where there are extensive mats of floating vegetation, particularly water hyacinths; rarely leaves the water.

Food: Primarily crayfish.

Reproduction: Young born alive.

References: Conant 1975.

Black swamp snake (Seminatrix pygaea)

Habitat: Almost any freshwater habitat, especially those with floating mats of aquatic vegetation in lakes, ponds, marshes, and roadside ditches.

Food: Earthworms, leeches, salamanders, fish, and frogs.

Reproduction: Young born alive.

References: Conant 1975; Dowling 1950.

Pine woods snake (Rhadinea flavilata)

Habitat: Occurs primarily in hammocks and bogs.

Food: Snakes, frogs, salamanders, lizards, and small rodents.

Reproduction: Eggs laid in late autumn in rotting logs and under debris.

Reference: Myers 1967.

Eastern mud snake (Farancia a. abacura)

Habitat: Common in permanent aquatic situations. Burrows in substrate.

Food: Frogs, salamanders, and fish.

Reproduction: Eggs laid in burrows in terrestrial situations.

References: Conant 1975; Wright and Wright 1957.

Eastern indigo snake (Drymarchon corais couperi)

Habitat: Moist habitats; in drier environments utilizes gopher tortoise burrows for shelter to prevent desiccation.

Food: Anything it can overpower including frogs, snakes, and small mammals.

Reproduction: Lays eggs in summer in rotting logs.

Reference: Kochman 1978.

Florida cottonmouth (Agkistrodon piscivorus conanti)

Habitat: Prefers aquatic and semi-aquatic habitats including ponds, rivers, and fresh and saltwater marshes.

Food: Frogs, salamanders, snakes, small turtles, and fish.

Reproduction: Young born alive.

References: Wharton 1969; Conant 1975.

D.4 Birds

Wading birds (Ciconiiformes)

Habitat: Swamps, ponds, lakes, streams, rivers, and marshes; rarely in dense wooded swamps.

Food: Fish, crayfish, frogs, lizards, insects, amphibians, mice, snails, beetles, water bugs, and worms.

Reproduction: Nest in trees in shrubby areas located in water. Heights of nests vary depending on vegetation.

References: Alexander et al. 1961; Nesbitt et al. 1974; Nesbitt 1973; Murdich 1978; Sprunt 1954.

Wood duck (*Aix sponsa*)

Habitat: Cypress swamps, wooded lakes, ponds, hardwood swamps, and mesic hammocks bordering streams.

Food: Beetles, tree bugs, ants, Hymenoptera, oak acorns, hickory seed, water lily, duckweed, ash and blackgum seed, *Bidens*, and coontail sedge.

Reproduction: Nests in cavities of trees or man-provided cavities; will nest as much as 1 mi from water in suitable cavities.

References: Alexander et al. 1961; Bellrose 1978.

Black vulture (*Coragyps atratus*)

Habitat: Dry prairie, pasture, wet prairie, and most other habitats; nests in swamps, saw palmetto, and scrub.

Food: Carrion; will take live animals, eggs and young from heron rookeries.

Reproduction: Nests on the ground, in hollow stumps in swamps, and in saw palmettos.

References: Alexander et al. 1961; Layne et al. 1977; Sprunt 1954; Bent 1961.

Swallow-tailed kite (*Elanoides forficatus*)

Habitat: Pinelands, hammocks, swamps, river floodplains, open grasslands, and marshy areas.

Food: Lizards, snakes, frogs, grasshoppers, and other large insects.

Reproduction: Summer breeder. Nests in high trees, either pine or cypress near cypress swamps.

References: Alexander et al. 1961; Bent 1961; Layne et al. 1977; Sprunt 1954.

Red-shouldered hawk (Buteo lineatus)

Habitat: Pine flatwoods, live oak and mesic hammocks, and hardwood and cypress swamps.

Food: Rodents, snakes, insects, and small birds.

Reproduction: Nests in cypress and pine on swamp borders in tree crotch 18-75 ft. above ground.

References: Alexander et al. 1961; Bent 1961; Layne et al. 1977.

Turkey (Meleagris gallopavo)

Habitat: Flatwoods, pine-oak uplands, swamps, hammocks, cypress areas, and drier swamps.

Food: Beetles, grasshoppers, crickets, tree bugs, moths, butterflies, millipedes, crayfish, nuts, acorns, and fruits of greenbrier, holly, and poison ivy.

Reproduction: Nests on ground in formed depressions in brush, palmettos, or at the bases of trees.

References: Alexander et al. 1961; Barwick et al. 1973; Layne et al. 1977; Powell 1965; Sprunt 1954; Schorger 1966.

Yellow-billed cuckoo (Coccyzus americanus)

Habitat: River swamps, hammocks, deciduous woodlands, mixed hardwood and cypress swamps, and live oak hammocks.

Food: Caterpillars, bugs, and grasshoppers.

Reproduction: Foliage, bushes or low limbs of trees in heavy undergrowth.

References: Alexander et al. 1961; Layne et al. 1977; Rowse 1980; Sprunt 1954.

Barred owl (Strix varia)

Habitat: Mixed hardwood swamp, cypress swamp, live oak and cabbage palm hammocks, and urban wooded areas.

Food: Rodents, frogs, rabbits, insects, crayfish, shrews, and birds.

Reproduction: Nests near wet areas in cavities, old red-shouldered hawk and crow nests, and in hollow limbs.

References: Alexander et al. 1961; Layne et al. 1977; Sprunt 1954; Bent 1961.

Pileated woodpecker (Dryocopus pileatus)

Habitat: Pine flatwoods, cabbage palm, live oak and mesic hammocks, and cypress swamps.

Food: Ants, beetle larvae, and fruits of grape, holly, dogwood, palmetto, blackgum, and Virginia creeper.

Reproduction: Nests in pine flatwoods, cypress, blackgum, oak, and cabbage palmetto; often in dead stubs 12-75 ft. above ground.

References: Alexander et al. 1961; Bent 1964c; Hirth and Marion 1979; Sprunt 1954.

Red-bellied woodpecker (Melanerpes carolinus)

Habitat: Pine flatwoods, pine-turkey oak, sandpine scrub, cabbage palm, live oak, mesic hammocks, and swamp areas.

Food: Beetles, ants, Hymenoptera, caterpillars, bugs, oak acorns, and fruits of blackberry and grape.

Reproduction: Nests in dead stubs of almost any tree species, and in live trees if no stubs available.

References: Alexander et al. 1961; Bent 1964c; Hirth and Marion 1979; Sprunt 1954.

Yellow-bellied sapsucker (Sphyrapicus varius varius)

Habitat: Pine-turkey oak, sandpine scrub, flatwoods, live oak and mesic hammocks, hardwood swamp, and bay forest.

Food: Wood and sap of maple, hackberry, holly, magnolia, oak, and pine; beetles, ants, Hymenoptera, and fruits of Virginia creeper and poison ivy.

Reproduction: Winter visitor.

References: Alexander et al. 1961; Bent 1964c; Sprunt 1954.

Acadian flycatcher (Empidonax virescens)

Habitat: Swamplands, cypress, tupelo gum, cypress bays.

Food: Flies, mosquitoes, moths, flying ants, small beetles.

Reproduction: Shrubs and low trees 4-20 ft., May-June.

References: Alexander et al. 1961; Sprunt 1954; Bent 1963a.

Tufted titmouse (Parus bicolor)

Habitat: Live oak and mesic hammocks, and hardwood swamps.

Food: Caterpillars, wasps, scale insects, ants, beetles, and fruits of oak, blackberry, hackberry, and Virginia creeper.

Reproduction: Nests in natural hollows, old woodpecker holes, and large crevices in trees.

References: Alexander et al. 1961; Layne et al. 1977; Sprunt 1954.

Carolina wren (Thryothorus ludovicianus)

Habitat: Pine flatwoods, pine-turkey oak, sandpine scrub, cabbage palm hammock, live oak hammock, mesic hammock, bay forest with dense undergrowth; prefers swamp lands and water courses with brushy borders.

Food: Ants, Hymenoptera, flies, millipedes, poison ivy, bayberry, pine, oak, sweetgum seeds, frogs, and small snakes.

Reproduction: Nests in brushy areas, stumps, crotches, roots, holes in banks.

References: Alexander et al. 1961; Layne et al. 1977; Sprunt 1954; Rowse 1980; Bent 1964a.

Hermit thrush (Catharus guttata)

Habitat: Hammocks, woodlands, and borders of wooded swamps.

Food: Beetles, ants, caterpillars, flies, holly, and fruits of greenbrier, dogwood, sumac, Vitis, and Virginia creeper.

Reproduction: Winter resident.

References: Alexander et al. 1961; Bent 1964b; Sprunt 1954.

Blue-gray gnatcatcher (Polioptila caerula)

Habitat: Pine-turkey oak, scrub, flatwoods, cabbage palm hammock, live oak and mesic hammocks, hardwood swamp, cypress swamp, bay forest, and swamp thickets.

Food: Insects.

Reproduction: Nests 3-8 ft. above ground in cypress, oak, pine, and hickory; nests near ground in low shrubs and trees.

References: Rowse 1980; Layne et al. 1977; Sprunt 1954; Bent 1964b.

White-eyed vireo (Vireo griseus)

Habitat: Scrubby flatwoods, live oak hammock, hardwood swamp, and bay forest; prefers dense understory.

Food: Caterpillars, moths, bugs, beetles, ants, wasps, bees, flies, and fruits of waxmyrtle, blackberry, holly, and Virginia creeper.

References: Alexander et al. 1961; Bent 1965b; Layne et al. 1977; Rowse 1980.

Solitary vireo (Vireo solitarius)

Habitat: Scrub, live oak and mesic hammocks, hardwood swamp, and swamp thickets.

Food: Caterpillars, moths, bugs, beetles, wasps, ants, bees, and flies.

Reproduction: Winter resident.

References: Alexander et al. 1961; Bent 1965b; Layne et al. 1977.

Warblers (Parulidae)

Habitat: Almost all shrub or wooded habitat in Florida. Many are migrants and take advantage of wooded areas such as hardwood swamps, mesic hammocks, and cypress areas.

Food: Insects and some vegetation.

Reproduction: Nests at varying heights in shrubby areas, trees, and herbaceous growth.

References: Alexander et al. 1961; Bent 1963b; Sprunt 1954.

Common grackle (Quiscalus quiscula)

Habitat: Pine flatwoods, live oak and mesic hammocks, parklands, cypress swamps, and brushy areas along water courses and ponds.

Food: Bees, grasshoppers, crickets, crustaceans (crayfish and sow bugs), toads, mice, bird eggs, corn, oats, ragweed, blackberry fruit, and bristlegrass.

Reproduction: Nests in trees and bushes 2-20 ft above ground; cypress domes and cypress areas around ponds.

References: Alexander et al. 1961; Hirth and Marion 1979; Layne et al. 1977; Bent 1965a.

White-throated sparrow (Zonotrichia albicollis)

Habitat: Swamps, oldfield edges, forest thickets, and wooded urban areas.

Food: Ants, parasitic Hymenoptera, beetles, bugs, flies, and caterpillars.

Reproduction: Winter resident.

References: Alexander et al. 1961; Sprunt 1954.

D.5 Mammals

Southeastern shrew (*Sorex l. longirostris*)

Habitat: River floodplains and swamps, including annually flooded areas. Also pinelands and hammocks.

Food: Primarily insects in leaf litter.

Reproduction: Not well known.

References: French 1974; National Fish and Wildlife Laboratory 1978.

Red bat (*Lasiurus borealis*)
Eastern pipistrelle (*Pipistrellus subflavus*)
Evening bat (*Nycticeius humeralis*)

Habitat: Roost in hollow trees and trees with Spanish moss. Feed over trees in mixed swamps.

Food: Primarily insects over aquatic areas.

Reproduction: Pipistrelle nursery roosts are in caves and culverts; Red bat nursery roosts are in trees; Evening bat nursery roosts are in trees and buildings.

References: Jennings 1958; Humphrey 1975; Barbour and Davis 1969.

Eastern gray squirrel (*Sciurus carolinensis*)

Habitat: Virtually all wooded areas, but primarily in hammock situations.

Food: Nuts and acorns.

Reproduction: Builds leaf nests or uses dens in trees.

Reference: Lowery 1974.

Cotton mouse (*Peromyscus gossypinus*)

Habitat: Primarily wooded areas such as pine flatwoods, hammocks, edges of marshes, cypress swamps, and mixed swamps; semi-arboreal.

Food: Primarily plant material, but also insects.

Reproduction: Nests are constructed under logs, in holes in trees, at the bases of stumps, or occasionally in abandoned squirrel or bird nests.

References: Layne 1970; Pearson 1953.

Golden mouse (Ochrotomys nuttalli)

Habitat: Mixed hardwoods, hammocks, bayheads, and hardwood bottoms.

Food: Primarily plant material, but also insects.

Reproduction: Nest of grasses, leaves, etc., placed from a few inches to approximately 15 ft. above ground in bush or vine.

References: Lowery 1974; McCarley 1958.

Eastern woodrat (Neotoma floridana)

Habitat: Numerous in hardwood bottoms and other moist areas; rare to absent in dry, wooded uplands.

Food: Plant material such as buds, seeds, nuts, roots, and tubers; succulent herbs; grasses; berries; and occasionally snails and insects.

Reproduction: Builds large, conspicuous stick nests on the ground and in the limbs of small trees.

References: Svihla and Svihla 1933; Neal 1967; Pearson 1952.

Rice rat (Oryzomys palustris)

Habitat: Wet, marshy areas including grassy ditches, edges of lakes and streams, and other moist places. Seldom found far from water.

Food: Succulent parts of plants, and small insects and crustaceans.

Reproduction: Nests in slight depressions on the ground in vegetation. Nests may also be found in vegetation tangles above ground if area inundated frequently.

References: Birkenholz 1963; Negus et al. 1961; Sharp 1967.

Florida black bear (Ursus americanus floridanus)

Habitat: Large swamps; usually associated with dense, practically impenetrable thickets. Optimum habitat is a combination of flatwoods, swamps, bayheads, and hammocks thoroughly interspersed.

Food: Acorns, berries, and terminal buds of saw and cabbage palmetto. Occasionally feral hogs and armadillos.

Reproduction: Denning sites in large cypress trees and in thickets.

References: Pelton and Nichols 1973; National Fish and Wildlife Laboratory 1978; Harlow 1962.

River otter (Lutra canadensis)

Habitat: Any locale with standing or moving water.

Food: Primarily fish and crayfish. Ranges 3-10 mi. in a season to feed.

Reproduction: Dens in burrows, cavities, tree roots, and vegetation thickets. Nest generally within several hundred ft. of water.

Reference: Lowery 1974.

Wild hog (Sus scrofa)

Habitat: Bogs, mixed swamps, hammocks, bottomland hardwoods.

Food: Plant and animal material.

Reproduction: Dens and thickets.

References: Hanson and Karstad 1959; Lowery 1974.

White-tailed deer (Odocoileus virginianus)

Habitat: Wide variety of habitats with close proximity to wetlands, scrub, and forested vegetation; dense ground cover necessary.

Food: Variety of plant material including oaks, holly, water lily, bladderwort, ferns, primrose willows, sedges, etc.

Reproduction: Availability of food is prime requirement.

Reference: Harlow and Jones 1965.

D.6 Literature Cited

Alexander, M.C., H.S. Zim, and A.L. Nelson. 1961. American wildlife and plants: a guide to wildlife food habits. Dover Publications, New York. 500 pp.

Allen, R. 1938. Notes on Florida water snake. Proc. Fla. Acad. Sci. 3:101-104.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University Press of Kentucky, Lexington. 286 pp.

Barney, R.L. 1920. Life history and ecology of the pigmy sunfish, Elassoma zonatum. Ecology 1:241-256.

Barwick, L.H., W.M. Hetrick, and L.E. Williams. 1973. Foods of young Florida wild turkeys. 27th Ann. Conf. of SE Assoc. of Game and Fish Comm.

Bellrose, F.C. 1978. Ducks, geese and swans of North America. Stackpole, Harrisburg, PA.

Bent, A.C. 1961. Life history of North American birds of prey. Dover Publications, New York. 482 pp.

Bent, A.C. 1963a. Life history of North American flycatchers, larks, swallows, and their allies. Dover Publications, New York. 555 pp.

Bent, A.C. 1963b. Life history of North American wood warblers (Parts 1 and 2). Dover Publications, New York. 734 pp.

Bent, A.C. 1964a. Life history of North American nuthatches, wrens, thrashers, and their allies. Dover Publications, New York. 475 pp.

Bent, A.C. 1964b. Life history of North American thrushes, kinglets, and their allies. Dover Publications, New York. 452 pp.

Bent, A.C. 1964c. Life history of North American woodpeckers. Dover Publications, New York. 354 pp.

Bent, A.C. 1965a. Life history of North American blackbirds, orioles, tanagers, and their allies. Dover Publications, New York. 549 pp.

Bent, A.C. 1965b. Life history of North American wagtails, shrikes, vireos, and their allies. Dover Publications, New York.

Birkenholz, D. 1963. Movement and displacement in the rice rat. Quart. J. Fla. Acad. Sci. 26:269-274.

Carlander, K.D. 1969. Handbook of freshwater fishery biology. Vol I. Iowa State University Press, Ames. 752 pp.

Carlander, K.D. 1977. Handbook of freshwater fishery biology. Vol II. Iowa State University Press, Ames. 431 pp.

Clay, W.M. 1975. The fishes of Kentucky. Kentucky Dept. of Fish and Wildlife Resources, Frankfort. 416 pp.

Conant, R. 1975. A field guide to reptiles and amphibians of eastern and central North America. Houghton Mifflin Co. Inc., Boston.

Dowling, H. 1950. Studies of the black swamp snake, Seminatrix pygaea Cope, with description of two new subspecies. Misc. Publ. Mus. Zool. Univ. Michigan 76:1-38.

Eddy, S. 1969. How to know the freshwater fishes. W.C. Brown Co., Dubuque, IO. 286 pp.

Ernst, C. 1974. Kinosternon bauri. ASIH Cat. Amer. Amphib. Rept. pp. 161.1-161.2.

Ernst, C., R. Barbour, and J. Butler. 1972. Habitat preference of two Florida turtles, genus Kinosternon. Trans. Kentucky Acad. Sci. 33:41-42.

Ernst, C., R. Barbour, E. Ernst, and J. Butler. 1973. Growth of the mud turtle, Kinosternon subrubrum, in Florida. Herpetologica 39:247-250.

Ernst, C., R. Barbour, E. Ernst, and J. Butler. 1974. Subspecific variation and intergradation in Florida of Kinosternon subrubrum. Herpetologica 30:317-320.

Fogarty, M.J. and H.W. Campbell. 1978. American alligator. Pages 65-67 in McDiarmid, R.W. (ed.), Amphibians and reptiles. Rare and endangered biota of Florida. University Presses of Florida, Gainesville. 74 pp.

French, T. 1974. Report on status of the southeastern shrew, Sorex longirostris. Unpubl. MS. 3 pp.

Goin, C. 1958. Comments upon the origin of the herpetofauna of Florida. Quart. J. Fla. Acad. Sci. 21(10):61-70.

Hanson, R.P. and L. Karstad. 1959. Feral swine in the southeastern United States. J. Wildl. Manage. 23:64-74.

Harlow, R.F. 1962. Black bear population investigation. Job completion report. Project No. W-41-R-9. Job No. 1-C. Fla. Game and Freshwater Fish Comm. 16 pp.

Harlow, R.F. and F.K. Jones, Jr. 1965. The white-tailed deer in Florida. Fla. Game and Freshwater Fish Comm., Tech Bull. No. 9. 240 pp.

Hirth, D.H. and W.R. Marion. 1979. Bird communities of a South Florida flatwoods. Fla. Sci. 42:142-151.

Huheey, J. 1959. Distribution and variation in the glossy water snake Natrix rigida (Say). Copeia 1959(4):303-311.

Humphrey, S.R. 1975. Nursery roosts and community diversity of nearctic bats. J. Mammal. 56:321-346.

Jennings, W.L. 1958. The ecological distribution of bats in Florida. Ph.D. dissertation, Univ. of Florida, Gainesville. 126 pp.

Kochman, H.I. 1978. Eastern indigo snake. Pages 68-69 in McDiarmid, R.W. (ed.), Amphibians and reptiles. Rare and endangered biota of Florida. University Presses of Florida, Gainesville. 74 pp.

Layne, J.N. 1970. Climbing behavior of Peromyscus floridanus and Peromyscus gossypinus. J. Mamm. 51:580-591.

Layne, J.N., J.A. Stallcup, G.E. Woolfenden, M.N. McCauley, and D.J. Worley. 1977. Fish and wildlife inventory of the seven-county region included in the Central Florida Phosphate Industry Areawide Environmental Impact Study. Archbold Biological Station, Lake Placid, Fl. 1279 pp.

Lee, D.S., C.R. Gilbert, C.H. Hocutt, R.E. Jenkins, D.E. McAllister, and J.R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. N.C. State Mus. Nat. Hist., Raleigh. 854 pp.

Lowery, G.H., Jr. 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University Press, Baton Rouge. 565 pp.

Martof, B. 1968. Ambystoma cingulatum. ASTH Catalogue Amer. Amphib. Rept. pp. 57.1-57.2.

McCarley, W.H. 1958. Ecology, behavior, and population dynamics of Peromyscus nuttalli in eastern Texas. Texas J. Sci. 10:147-171.

Murdich, W.H. 1978. The feeding ecology of five species of herons in a north-central Florida marsh. M.S. thesis, Univ. of Florida, Gainesville.

Myers, C. 1967. The pine woods snake, Rhadinea flavilata (Cope). Bull. Fla. St. Mus. 11(2):47-97.

National Fish and Wildlife Laboratory. 1978. Osceola National Forest phosphate extraction and processing: impacts on federally listed threatened or endangered and other species of concern. National Fish and Wildlife Laboratory, Gainesville, FL. 414 pp.

Neal, W.A. 1967. A study of the ecology of the woodrat in the hardwood forests of the lower Mississippi River basin. M.S. thesis, Louisiana State University, Baton Rouge. 116 pp.

Negus, N.C., E. Gould, and R.K. Chipman. 1961. Ecology of the rice rat, Oryzomys palustris (Harlan), on Breton Island, Gulf of Mexico, with a critique of social stress theory. Tulane Studies Zool. 8:93-123.

Neill, W.T. 1951. A new subspecies of dusky salamander, genus Desmognathus from south-central Florida. Publ. Res. Div. Ross Allen's Rept. Inst. 1(3):25-28.

Neill, W.T. 1971. The last of the ruling reptiles: alligators, crocodiles, and their kin. Columbia University Press, New York. 486 pp.

Nesbitt, S.A. 1973. Wood stork nesting in north Florida. Fla. Field Nat. 2(1).

Nesbitt, S.A., W.M. Hetrick, and L.E. Williams. 1974. Food of white ibis from seven collection sites in Florida. Proc. 28th Ann. Conf. of SE Game and Fish Comm.

Pearson, P.G. 1952. Observations concerning the life history and ecology of the woodrat, Neotoma floridana floridana (Ord.). J. Mammal. 33:459-463.

Pearson, P.G. 1953. A field study of Peromyscus populations in Gulf Hammock, Florida. Ecology 24:199-202.

Pelton, M.R. and R.G. Nichols. 1973. Status of the black bear (Ursus americanus) in the southeast. In Miller, R.L. (ed.), Proceedings of 1972 Black Bear Conference, Delmar, NY. 55 pp.

Powell, J.A. 1965. The Florida wild turkey. Florida Game and Freshwater Fish Comm., Tallahassee.

Reimer, R.D. 1970. A food study of Heterandria formosa Agassiz. Amer. Midl. Nat. 83:311-315.

Rossman, D. 1959. Ecosystematic relationships of the salamander Desmognathus fuscus auriculatus Holbrook and Desmognathus fuscus carri Neill. Herpetologica 15(4):149-155.

Rowse, L.A. 1980. Avian community composition of a North Florida flatwoods. M.S. thesis, Univ. of Florida, Gainesville. 69 pp.

Schorger, A.W. 1966. The wild turkey. University of Oklahoma Press, Norman. 625 pp.

Sharp, H.F., Jr. 1967. Food ecology of the rice rat, Oryzomys palustris (Harlan), in a Georgia salt marsh. J. Mammal. 48:557-563.

Sprunt, A. 1954 (with 1963 addendum). Florida bird life. Coward-McCann, Inc., New York, and National Audubon Society. 511 pp.

Svihla, A. and R.D. Svihla. 1933. Notes on the life history of the woodrat, Neotoma floridana rubida Bangs. J. Mammal. 14:73-75.

Telford, S. 1954. A description of the larvae of Ambystoma cingulatum bishopi Goin, including an extension of the range. Quart. J. Fla. Acad. Sci. 17(4):233-238.

Wharton, C. 1969. The cottonmouth moccasin on Sea Horse Key, Florida. Bull. Florida St. Mus. 14(3):227-272.

Wright, A.H. and A.A. Wright. 1932. Life histories of the frogs of Okefenokee Swamp, Georgia. Macmillan Co., Inc., New York. 497 pp.

Wright, A.H. and A.A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. Cornell University Press, Ithaca, NY. 640 pp.

Wright, A.H. and A.A. Wright. 1957. Handbook of snakes. Cornell University Press, Ithaca, NY. 1105 pp.